ENGINEERING NEWS-RECORD

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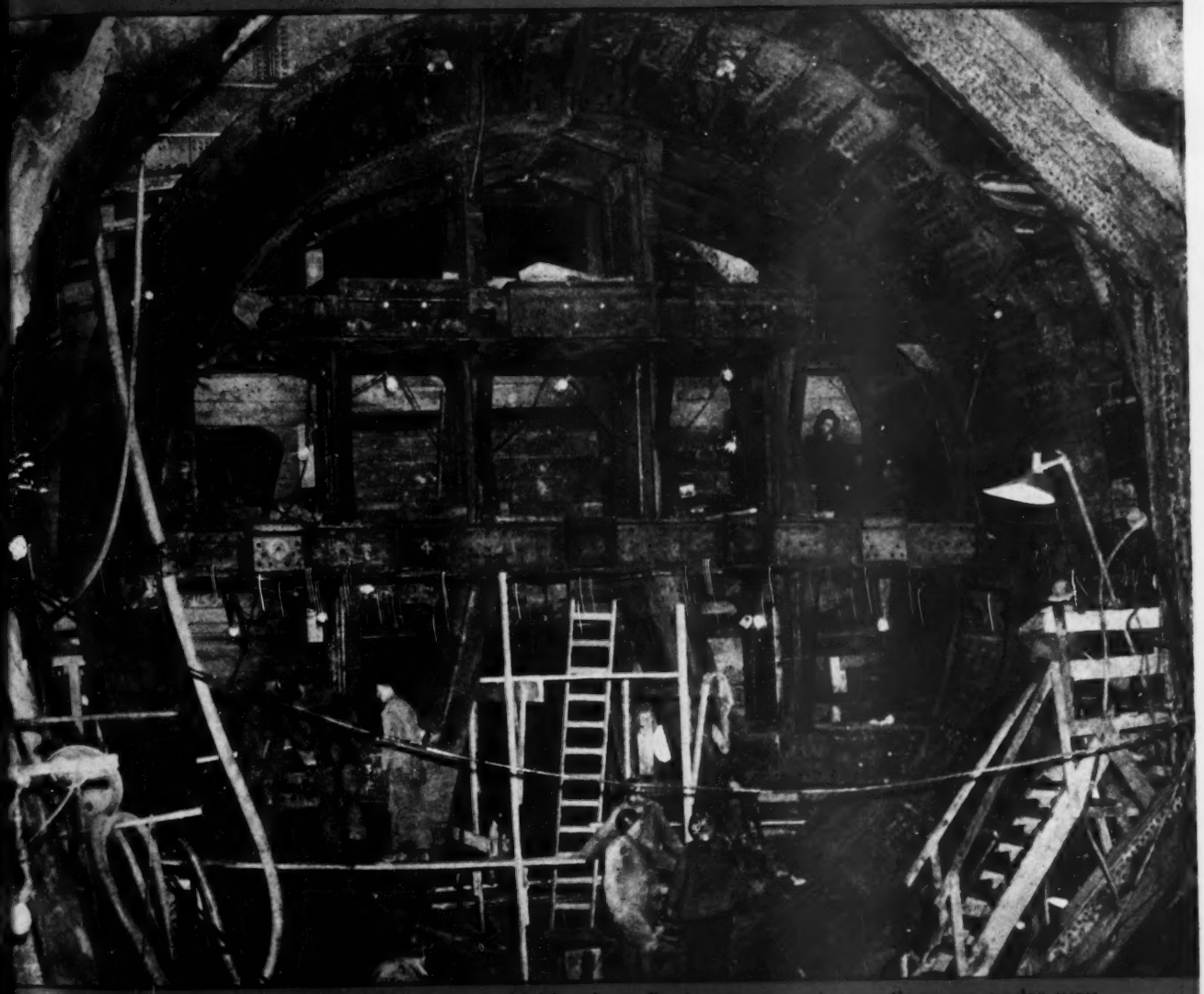
JUNE 12, 1947



Forward end of the Brooklyn-Battery Tunnel shield, where final enlargement operations are under way

In This Issue— **HOW SAFE IS A "FIRESAFE" BUILDING?**

CHANGES MADE IN DAVIS DAM DESIGN

IN THE MODERN OFFICE BUILDING OF JOHNSON WAX
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in a NEW TYPE OF HEATING
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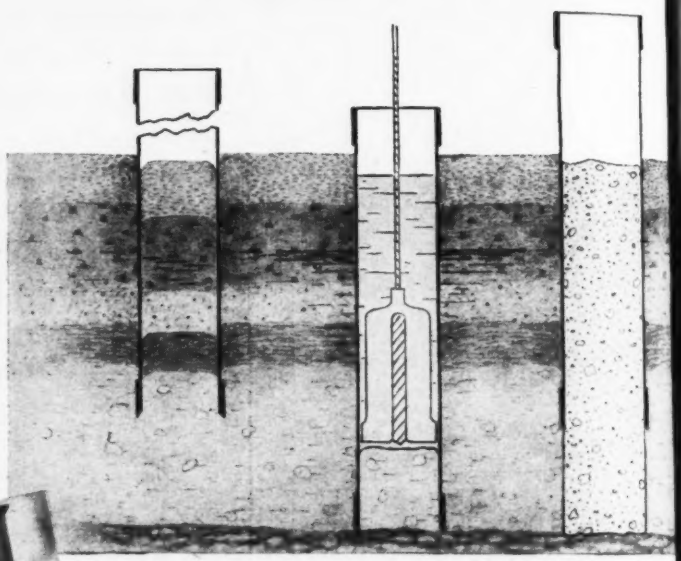

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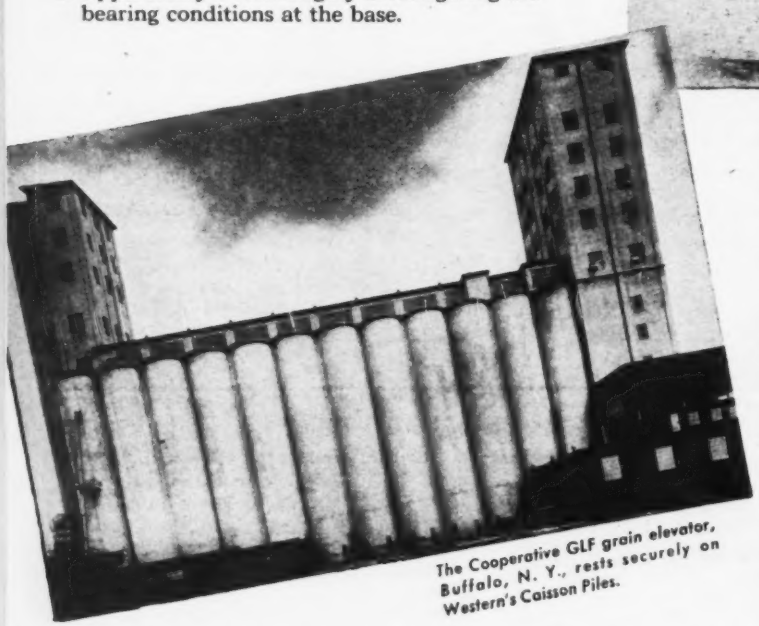

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News of the Week

ENGINEERING NEWS-RECORD • JUNE 12, 1947 • VOLUME 138 • NUMBER 24

Congress approval seen near for huge hospital program

Conference report near on measures to provide construction funds for program originally set at more than $4 billion for new structures

Contractural authority permitting the U. S. Public Health Service to place under construction the large civilian hospital program approved by the last Congress (*ENR* July 25, 1946, vol. p. 90) is provided in the general appropriation bill (H. R. 2700) for that agency already passed by both branches of the present Congress.

The Senate version provides authority for the health service to enter into contracts obligating Congress to provide $40,000,000 of federal aid. The House had approved $150,000,000. Therefore, the compromise measure—which will soon go to the President for signature—will permit a major start this year on a program that calls for $75,000,000 of federal aid annually for five years.

Needs are extensive

Known as the Hospital Survey and Construction Act, last year's comprehensive law was passed after the Surgeon General's office had revealed that nearly $4 billion of construction was needed by the states for hospitals and health centers (based upon prewar construction prices). These studies showed that the demand for new general hospitals totaled more than $1 billion and replacement and enlargement of such hospitals would require an additional $500,000,000. Tuberculosis hospital needs, including replacements, were calculated at over $400,000,000 and mental hospital requirements at nearly $1 billion. Chronic hospital requirements accounted for above $800,000,000 and public health centers over $270,000,000.

In view of this great need, Congress authorized appropriation of $75,000,000 for construction during the present fiscal year and an equal amount for each of the four succeeding years, plus $3,000,000 for detailed surveys and planning assistance to the various states. However legislators are just now getting around to doing something about appropriation for construction.

Because the construction program was scheduled to start this fiscal year, (ends June 30), the House favors contractural authority in the amount of $150,000,000—the amount originally scheduled for the first two years of the program. However, because of current high construction costs and the slow pace of the veterans housing work, the Senate favors the PHS entering into contracts to an amount requiring only $40,000,000. The final amount should be decided during the next few days. It is expected that the assistance will be provided in a similar manner to that extended by the Public Roads Administration—PHS will be permitted to enter into contracts committing Congress to provide the federal funds later as they are needed.

Program soon to start

Regardless of the amount of contract authority decided upon, the health service will be ready to start the program when that authority is received, according to Dr. V. M. Hoge, chief of PHS's Hospital Facilities Division.

Before recessing last summer, Congress appropriated $2,350,000 for detailed surveys and planning (*ENR* Sept. 26, 1946 vol. p. 412). Based upon a new comprehensive survey of the country's needs, the health service is expected to report at an early date the necessity for a program much greater than that previously outlined.

PHS has prepared detailed regulations for the method of extending the assistance to the states and local groups. General standards of construction have also been prepared, and state groups have been assisted in their planning with the $2,350,000 appropriation.

Distribution of the aid for construction will be based upon a complicated formula selected by the last Congress. This formula takes into consideration both the population of a state and the per capita income of each state. The allotments to the various states for $75,000,000 under the formula were published in table form in *ENR* Sept. 26, 1946, vol. p. 412.

Jobs require state approval

Local groups wishing to obtain assistance under the program must work through the hospital agency for that state. All projects must be a part of a state program approved by that state and the Surgeon General's office. Federal assistance will be limited to 33⅓ percent of the cost of a project.

Medical corps to include sanitary men

A bill (H. R. 3215) creating a medical department in both the Army and Navy, with sanitary engineers of each service subordinate to medical officers, was passed by the House June 2. Early action by the Senate appears probable.

The provisions of the bill were originally presented to the House Committee of The Whole in three separate bills: H. R. 1982, establishing a Medical Service Corps in the Army; H. R. 1361, setting up the commissioned grade of Medical Administrator in the Hospital Corps of the Navy, and H. R. 1603, establishing a Medical Associated Sciences Corps in the Medical Department of the Navy. These three bills were later combined as H. R. 3215.

The new department created in the Army would be staffed by about 1,000 officers, while that in the Navy would contain 863 officers. The present Sanitary Corps of the Army would be made a part of the new department and thus sanitary engineers would be placed under the direction of medical officers.

At the hearings held by the House committee, little opposition to this setup was indicated, and the House report made no mention of the subordinate role sanitary engineers would play. Unless strong opposition develops in the Senate, the bill will probably become law this session.

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Public Construction—Brooks-Borg Inc., Des Moines, Iowa, architects, have received a contract for planning a $440,000 addition to the electrical engineering building at Iowa State College, *Ames*, and also a $525,000 contract for a communications building at the University of Iowa, *Iowa City* . . . The state of Florida has received approval for construction of a state supreme court building at *Tallahassee*. To cost $1,600,000 . . . G. M. Weir, minister of education for *British Columbia*, forecasts expenditures of $10,000,000 for expansion at the Vancouver General Hospital. . . OHE has approved *New York City's* application to construct foundation and frame for a $1,250,000 chronic disease unit at the Metropolitan Hospital. . .

Industrial Construction—*Des Moines, Iowa*, will erect a $600,000 furnace factory for the Armstrong Furnace Co. . . . Tampa Electric Co., *Tampa, Fla.*, has plans to expand its Hookers Point generating station to provide two new 30,000 kw. units at a cost of $9,500,000. . . A new $2,000,000 shopping center will be started soon at *Vestal, N. Y.* . . . American Foundry Co. will build a new foundry at *Indianapolis, Ind.*, to cost over $2,000,000.

Highways—During the next 15 years *Florida* should build 42,218 miles of roads to cost about $100,000,000, according to the State Road Department. . . *Virginia* highway department is proceeding with the construction of two highway projects near *Bristol* to cost $680,000. . .Details of a $22,984,000 highway construction and improvement budget for 1947-48 have been submitted to the state highway commission and the Arizona State-Wide Highway Planning Committee by W. C. Lefebvre, *Arizona* state highway engineer. The total includes $12,502,000 worth of state primary system projects recommended for construction during the coming fiscal year; $5,440,000 worth of state secondary system construction, and $4,033,000 worth of county primary system road building and improvements.

Housing—An attempt is being made in *East St. Louis, Ill.*, to obtain $500,000 from the Reconstruction Finance Corporation to erect 150 new Wingfoot ready made houses to rent to war veterans at from $30 to $35 a month. . .East Lawn Development Co. is planning a 14-acre housing development at *East Savanna, Ill.* . . .Work has begun on a $2,000,000 housing project in *Salina, N. Y.*, by Louis Gressani, Syracuse contractor. . . . At *Atlanta*, and *Decatur, Ga.*, three projects totalling 610 units are planned, to cost $5,466,000.

Labor—The *Cincinnati, Ohio*, Division, Associated General Contractors, has signed a new contract with the Carpenters District Council, AFL, providing a 17½-cent an hour wage increase. . . .Plumbers at *Lorain, Ohio*, have been granted a wage raise of 12½ cents an hour, to match the Cleveland rate of $2.12½ an hour. . . .An offer to arbitrate a wage dispute between the Building Contractors Association of *Indianapolis, Ind.*, and 2,000 striking carpenters has been made by the contractors. The strike centers around the union's demand for $2 an hour. Highest offer of the contractors was $1.92½ an hour. . . .Increase of 15 cents an hour has been agreed on by the *Calgary, Alta.*, General Contractors Association and the Amalgamated Building and Construction Workers Union, C.C.L. . . . *Kewanee, Ill.*, has increased by 15 cents an hour wages paid to members of the Municipal Employees Union, AFL. . .At *Edwardesville, Ill.*, street department workers will receive $1.25 an hour for a 35-hour week.

Ask bids for long tunnel at Toketee Falls, Ore.

The California-Oregon Power Co. of Medford, Ore., will invite bids this month for a 5,600-ft. reinforced concrete tunnel, the first major construction phase of a $4,000,000 hydroelectric development at Toketee Falls, according to John C. Boyle, general manager.

The firm now is completing a 50-man construction camp near the falls and preparing to build a 200-man camp at the powerhouse site.

Specifications prepared by the Public Engineering Service Corp. of Chicago call for a tunnel of 12-ft. diameter with concrete lining and with conduits connecting the diversion dam to the powerhouse. The diversion dam, built on sand and gravel and steel pipe cut-off, will have a main earthfill section 45 ft. high and 350 ft. long at the crest. The project also will include a short concrete gravity dam and concrete overflow spillway section with concrete lined channel leading to the river below the dam to flank the main section on one bank.

Construction of the tunnel is expected to get under way in October.

Chain-of-Rocks low bid tops $16 million

Low bid submitted last week for construction of the Chain-of-Rocks Canal on the Mississippi River was recorded at $16,626,000, according to Army engineers. Low bidder was the River Construction Co., of New York City, a combination of the firms of Spencer, White and Prentis, Raymond Concrete Pile Co. and the Turner Construction Co., all of New York City, Morrison-Knudsen of Boise, Idaho and Winston Brothers, of Minneapolis, Minn.

The work will be done under supervision of the Upper Mississippi Valley Division and the St. Louis Division of the Corps of Engineers. Located in Cabaret Chute, in Illinois (*ENR* April 10, vol. p. 550) the project will comprise a main lock 1,200 ft. long by 110 ft. wide—largest on the river—and an auxiliary lock 600 x 110 ft. Overall length of the lock structure is 1,732 ft. and total length of the contract is 3,400 ft. The locks will be on the line of a proposed 8.4-mi. canal to bypass the Chain-of-Rocks reach of the river.

B. H. Tallamy appointed N. Y. state works engineer

Effective July 1, Bertram H. Tallamy, since 1945 deputy superintendent, has been appointed chief engineer of the New York State Department of Public Works to succeed Maj. Gen. Thomas F. Farrell who leaves July 1 to become chairman of the New York City Housing Authority (*ENR* May 15, vol, p. 794).

Mr. Tallamy was graduated from Rensselaer Polytechnic Institute as a civil engineer in 1925, and became a member of the consulting engineering firm of Fretts, Tallamy, Senior, and Forrestal. Mr. Tallamy was also chief engineer of the Niagara Frontier Planning Board, and in his service with the state has been responsible for much of the planning to modernize New York State's highway system.

Claude A. Bonaparte will succeed as deputy superintendent of public works. In 1919, he was graduated from Tri State College with a B. S. degree in civil engineering, and later studied at Columbia University. He did research work for Thomas A. Edison in reinforced concrete from 1920-1922, and then served as assistant county engineer for Orange County, N. Y. From 1925-1930 he served as engineer in charge of all construction forces for Westchester County. In 1942 he acted as chief engineer on construction of the ATC Base at Memphis, Tenn.

Floods hit northern sector of U. S. as rains force streams over banks

Month-long series of storms push rivers and tributaries over banks —Three dams fail near Rutland, Vermont—Tornados hit in midwest and southwest

Swollen by heavy and almost continuous rains throughout May and early June, streams throughout the northern half of the United States went over their banks last week in a series of localized but disastrous floods that caused some loss of life and considerable damage to property and structures.

Floods of varying intensity were reported in New York State and New England, in Indiana, Iowa and along the upper reaches of the Mississippi, and as far west as Western Oregon. Meanwhile, a series of tornados was reported damaging towns in Oklahoma and Kansas, and another twister hit northeastern Colorado.

Most serious damage from an engineering standpoint, according to *ENR* staff correspondents, appeared to have occurred in and around Rutland, Vt., where one relatively small power dam was washed out and three others badly damaged by the waters of East Creek. Considerable damage was reported to the city of Rutland and its utilities, and to farms and utilities in the area.

In New York State, a small timber crib dam on the Black River, near McKeever, was taken out by the floods, and the Mohawk River and its numerous tributary streams went over their banks. Both in the New York and New England areas overnight rains varying from three to six inches were reported as primary cause of the floods.

In the Rutland area, the damage apparently started with excessive flow over Chittenden Dam—a masonry-core wall and compacted earthfill structure farthest upstream on East Creek. The dam's spillway was badly eroded but did not give way. However, excessive flow caused the failure of the dam at East Pittsford. This structure, also a masonry core wall and earthfill dam, was 110 ft. long, with a maximum height of 40 ft. Apparently due to overtopping, the entire dam failed and was washed out, releasing some 3,500 ac.ft. of water to race down the comparatively narrow river valley in a 9-ft. wall. The East Pittsford Dam had channelled water into a 220-ft. head, 1,600 kw. powerhouse, which was also seriously damaged. A third and fourth dam below East Pittsford, both used to direct the flow of the river into smaller powerhouses, also washed badly.

A partial estimate placed damage at about $2,000,000—one fourth or more of which was sustained by the Central Vermont Public Service Corp., a private utility which owns the structure. Rutland city water supply service was disrupted, and drinking water supplies were brought in by tank truck, while the mains were filled with creek water for sanitary use.

In the New York area, a report from the Black River Regulating District, said that stream flow in the Black River reached a peak of 25,000 cfs. on June 5, as a combined result of the melting of a heavy accumulation of snow and the abnormal rainfall.

The dam at McKeever, owned by the Gould Paper Co., was 22 ft. high and had a pondage area of only a few acres.

Most serious damage occurred to farmlands and highway and railroad structures in the Mohawk Valley, although flood conditions were reported throughout the Adirondack Mountains.

Floods in midwest

In the midwest, the swollen Des Moines River went over its banks near Ottumwa, Iowa, causing an estimated seven deaths and "considerable damage to farmlands, dwellings, highways and other installations. The Ottumwa municipal power plant, while still operating, was threatened by the waters, and authorities declared a medical emergency when the city's water supply was inundated.

In Indiana, many acres of farmland were reported under water as streams there overflowed.

As the floodwaters of the DesMoines River reached their junction with the Mississippi, the small town of Alexandria, Mo., at the junction point, was flooded when four small levees broke. The Mississippi was reported in flood from Keokuk, Iowa to Louisana, Missouri, exceeding the flood of 1944.

What was described locally as a cloudburst flooded sections south of The Dalles, Ore., and the rush of waters loosened hillsides, causing landslides and other damage.

Streams in southern Canada, just north of the U. S. border, were also swollen by the heavy rains, and went over their banks in many areas, causing considerable damage to farmlands, highways and railroad installations.

As a result of flood waters on the Thames River and Trout Creek, in Ontario, representatives of 54 cities and towns in the Thames watershed voted to ask the formation of a valley authority to construct and operate flood-control facilities. The vote, however, was 28 to 26, and under existing provincial legislation, a two-thirds vote of the communities affected must be obtained before such an authority can be established.

U. S. Weather Bureau stations reported "torrential" rains during the week as prelude to the floods. More than three inches fell in Northern Vermont on June 2; more than 5 in. in central and southern Iowa on June 4.

Wide World Photo

***Flood Result** — series of flash floods in upper New York State and throughout New England, resulting from abnormally heavy rainfalls, damaged highways, railroads and other structures last week. Typical of the damage was this washout along the tracks of the Erie Railroad, where the flood washed out a small culvert and a section of the embankment.*

Court ends inter-county flood control controversy

An attempt by King County, Wash., to terminate an agreement with Pierce County for financing the Inter-County River Improvement Commission to control the flood waters of the White, Stuck and Puyallup rivers in western Washington failed recently when Superior Judge H. G. Sutton ruled in favor of Pierce County.

The original contract, entered into in 1914 and modified in 1921, was to run 107 years. By its terms the two counties were to spend up to $50,000 annually in flood control work—60 percent to be contributed by King County.

King County contended the contract, by terms of the 1921 modification, ended last Jan. 1. Pierce County, on the other hand, maintained it has 74 years yet to run. Judge Sutton, agreeing with Pierce County's contention, held omission of the 74-year clause from the 1921 supplemental agreement was a "mutual mistake" and not intended by the contracting counties.

King County asserts construction of Mud Mountain Dam several years ago solved its flood problem and King County no longer benefits from the inter-county fund.

Bid tops $14 million for Buffalo VA hospital

Four eastern construction firms, submitting a single bid, were the apparent low bidder last week for five major building items involved in the construction of a new Veterans Administration hospital in Buffalo, N. Y. Low bid totalled $14,217,000.

Submitting the apparent low bid was the combination of: Grove, Shepherd, Wilson and Kruge, Inc., N. Y. city; Johnson, Drake and Piper, Inc., New York City; Charles H. Tompkins Co., Washington, D. C., and P. Fuhrman, Inc., New York City. The bid was the only one submitted under "Alternate A", which calls for bids on all items excepting work on lighting and elevators.

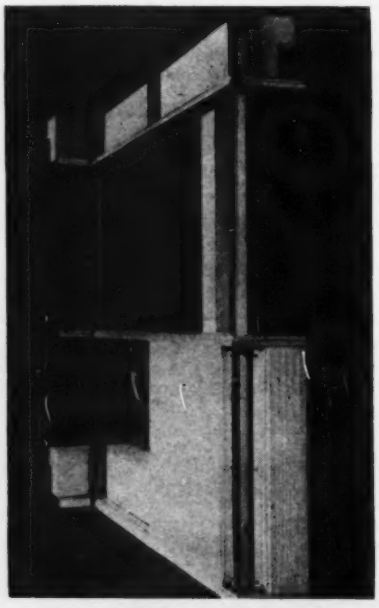
Indiana hospital plans

Plans for a $26,000,000 hospital construction and improvement program for Indiana over a 25-year period were announced June 2 by the the Indiana State Board of Health. Under the plan, Indianapolis would be the base hospital area. Gary, South Bend, Fort Wayne, Lafayette, Muncie, Terre Haute, Evansville and New Albany would be intermediate hospital areas. Each intermediate area would contain a network of rural hospitals and health centers.

Launch 10-year building program at Vancouver

Vancouver, B. C., is launching its 16-year $50,000,000 improvement program, and the borrowing of $3,394,000 for streets, sewers, schools and other civic improvements, which have been authorized by the city council. The first money borrowed will be for expenditure of $750,000 on the sewerage system; $450,000 on waterworks; $500,000 for street improvements; $450,000 for general purposes, including $250,000 for new equipment for the public works and water works departments; and $900,000 for schools.

The council has earmarked funds for preliminary work on the Granville Street bridge, a 2-deck structure with a 66-ft. roadway on the upper deck to accommodate two railway tracks. The roadway on the lower deck would be 45 ft. wide and would also carry two street railway tracks and provide a separate lane for bicycles. It is estimated that this double roadway accommodation would permit a movement of 5,500 automobiles per hour in each direction.



***New Wall Unit**—First public showing was made June 5 in New York City of an insulated, metal-faced exterior wall panel, developed by William Lescaze and Robert Davison, under sponsorship of the New York Housing Trust, the Republic Steel Corp. and the Pittsburgh-Corning Corp. The 52-in. square, 3½ in. thick unit is said to weigh less than 200 lb., can be quickly erected, and sponsors claim it is six times better as insulation against heat than a solid 13-in. masonry wall. Model shown is a Republic Steel modification of the Lescaze-Davison design.*

Approve construction of 39-story Time building

Initial construction work on a 39-story office and store building to replace the $9,000,000 Marguery Hotel and apartments at Park and Madison avenues between East 47th and East 48th streets, Manhattan, New York City, has been sanctioned by the Office of the Housing Expediter.

A major portion of the 1,000,000 sq. ft. of space in the new building will be occupied by Time, Inc., and its associated publications.

The OHE approval covers construction of foundations and structural steel work on the skyscraper at a cost of $5,500,000. The total outlay involved will be about $23,000,000. The federal agency reported that it had been led to permit this work, the largest private postwar project in Manhattan, in order "to relieve excessive unemployment among the heavy construction trades."

Licensing bill prepared for District of Columbia

A bill establishing a procedure for the licensing of professional engineers in the District of Columbia has been prepared as a cooperative project of the 15 organizations represented by the District of Columbia Council of Engineering and Architectural Societies. A number of the local sections of the societies, including that of the American Society of Civil Engineers, have already approved the bill and early approval by all 15 groups is expected.

The new bill contains a "grandfather" clause, but is free of the peculiar exemptions that appeared in previous bills, such as that avoiding the need for employment of a registered engineer on industrial projects costing less than $5,000. Young engineers would be permitted to take the licensing examinations in engineering theory upon completion of college work.

Registration would be handled by a five-man board of engineers appointed by the commissioners of the District of Columbia, the board being made up of one representative for each of the branches of engineering.

Because Congress is expected to recess July 31, chances of getting the measure through Congress this session appear slim. However, in view of the extensive support that exists for a registration law, passage of the bill at the next session appears probable.

The district is the only unit in the U. S. that does not now require registration.

EUROPEAN NOTEBOOK . . . .

Bavarian Reconstruction

by WALDO G. BOWMAN

Munich, Bavaria—In this largest city in Germany's largest state, excepting Prussia, there is perceptibly more rebuilding going on than in Berlin.

An old and highly industrial city, it suffered severe and deserved damage so that reconstruction is relatively no easier than in the capital city. But walls are being rebuilt and roofs framed and covered to an extent that makes the characteristic log falsework held together by ropes or chains a common sight. Brick is the predominant material—since mountains of it are available in the rubble—and lumber is plentiful, forests being not far distant.

Those who visited Munich in more peaceful days and liked its heterogeneous architecture and ancient public buildings would find a pilgrimage today a sad one. St. Peter's Church, dating from 1181, is an unrecognizable ruin, and the Church of Our Lady is gutted and open to the weather, although its unique dome-topped towers still stand. Ludwigstrasse is lined with the rubble and gaping walls of its classic buildings, and the old Art Gallery cannot be imagined as a once notable example of fine Renaissance architecture. Munich's rebuilding efforts center on more useful structures—houses and places of business.

Army Engineer work in Bavaria emanates from the Munich Area Engineer office located in a fine building on one of the former German airfields. Col. Clifford S. Urwiller is area engineer, and his deputy is Lt. Col. Glenn Reeves, formerly of the Port of New York Authority. Officially they head the 554 Engineer Composite Group, and have 35 engineer officers and 35 War Department civilians on their staff.

Two service companies (utilities) and a colored battalion containing two dump truck companies and a construction company, and a depot and maintenance detachment make up the troop complement, totaling 700 men. There are also 250 displaced persons in labor service units, and for the rest of the work force Germans are hired. Providing quarters and maintaining utilities for the Americans in Bavaria is the principal occupation.

The Army Engineers have also given signal aid in safeguarding the water supplies in Bavaria by chlorination, not widely practiced by the Germans heretofore. Many local epidemics of typhoid have occurred, and statistically there is as much of this disease in Bavaria now as in all of Germany before the war. The Bavarians, however, take some solace in the fact that 1½ million displaced persons have been passed through or lodged in their country without any really widespread epidemics. Tuberculosis in Bavaria as in the rest of Germany, is the greatest public health menace, but unfavorable diet and living conditions make its increase difficult to arrest.

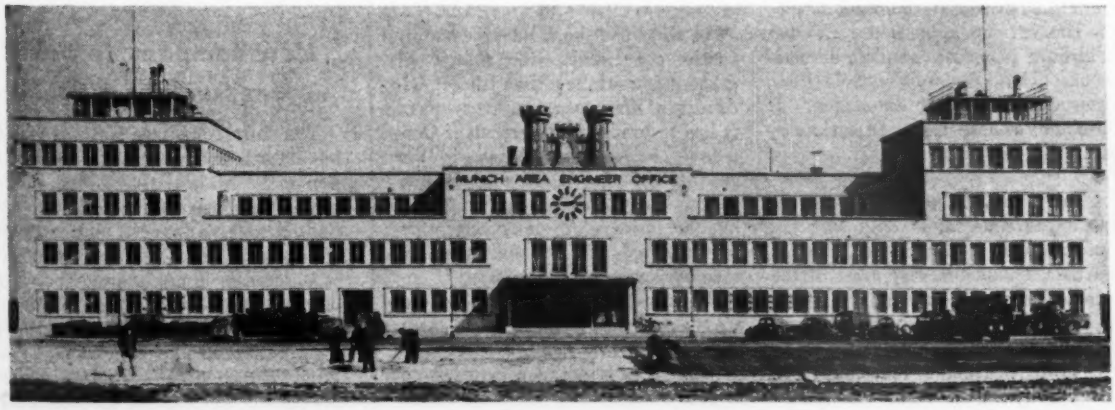
The most notable reconstruction in the area, from an engineering standpoint, is the rebuilding of the famous Mangfall Viaduct on the autobahn near Holzkirchen, 20 miles southeast of the city. This is a government undertaking being carried out by the contracting firm of Dickerhoff & Widmann. On new concrete piers, each made up of two hollow legs 165 ft. high, is carried a 3-span continuous truss with a center span of about 290 ft.

Three lines of parallel chord trusses, 12 ft. on centers and about 20 ft. deep, will support the roadway, and are being erected by cantilevering. Tiedowns at the abutment of the first span are supplemented by a huge rockfilled box counterweight. At the pier over which the main span was cantilevered, the normal truss depth is doubled by the temporary use of the third span steel over a 100-ft. length.

All the field joints are connected with pin-type bolts making this probably the largest bridge ever so assembled. The erection carriage, hung from the forward end of the steelwork, is equipped with two electric hoists which set the bridge members brought out on an industrial railway. It is a spectacular job, as befits a replacement of what was the longest plate girder span in the world, a 354-ft. continuous girder.

On this same trip another plate girder bridge over a high ravine similar to that at Mangfall was encountered, but other than removal of the wrecked steelwork no attempt at reconstruction has been made. A later drive on this same autobahn

(*Continued on following page*)



***U. S. Headquarters**—Housed in the building which was once an office for the German Luftwaffe, are headquarters for Army Engineer detachments stationed at Munich, Bavaria.*

(*Continued from page* 89)
(express highway) all the way to Berchtesgaden, 80 miles from Munich, revealed no other bridge damage. The 20-ft. roadways of the autobahn, either side of a center dividing strip, are undamaged, and the surfaces are in good repair.

Much has been written about Hitler's mountain retreat high up above the old Alpine resort town of Berchtesgaden, but the lavish layout that the "big" Nazis built for themselves and their Fuehrer must be seen to be appreciated. Engineering interest centers in the underground labyrinth that underlies the surface installations spread out on the side and top of a mountain that rises about 4,500 ft. above Berchtesgaden.

About half way up, at the little village of Ober Salzburg, such well known Nazis as Goering, Himmler, Borman, Hitler and others built magnificent homes.

Beneath these houses, and connecting all of them as well as the Storm Troops barracks nearby, are three miles of tunnels and numerous rooms in which were located power plants, laundries, sleeping, living and eating quarters. The tunnels are about 8 ft. in diameter, while some of the rooms are as much as 40 ft. square, with ceiling heights of about 10 ft. Some of this underground system is lined with granite, but most of it is unfinished. Forced ventilation kept the rooms livable, and an underfloor drainage system helped to keep them dry.

According to local reports, the tunneling was carried out by no unusual methods—unless the prodigal use of manpower is unusual. Mining was by hand, but haulage of spoil was done by industrial rail cars pulled by battery locomotives.

The surface appearance of Ober Salzburg is one of complete devastation. The underground system, however is virtually untouched. It probably will be destroyed in time by our Army Engineers.

But Ober Salzburg, although the principal element, is only half the mountain retreat. Some 2,000 ft. farther up, on the very crest of the mountain, is Hitler's other famous house, the Eagle's Nest. He reportedly visited it only five times.

The drive from Berchtesgaden to Ober Salzburg is over a wide mountain highway equal to the best in the U. S., and probably exceeding ours in the excellence of the retaining walls, all made of cut granite, carefully laid and extensively used. From Ober Salzburg to the Eagle's Nest, the road narrows and steepens so that only jeeps and army command cars can negotiate it, but the road is safe and smooth nevertheless. Three tunnels are encountered, the longest of about 1,000 ft., and all are, or were, closable by steel doors.

The road ends at a parking area 400 ft. below the house, and the rest of the way is covered on foot or in an elevator. Hitler used the elevator, and so did we. One enters it through a 10-ft. diam. tunnel about 100 yards long whose entrance is closed by double 4 in. thick bronze doors arranged like an air lock. The inner end of the tunnel opens into a circular lobby 20 ft. in diam. with a domed roof whose top is 30 ft. above the floor. All of this underground layout is lined with beautifully cut granite laid with deeply raked joints.

The house itself is a massive thing of granite, built on several levels. Its most interesting room is a circular affair, 40 ft. in diameter, with an oak beam ceiling and five 8-ft. square windows deeply recessed in the walls providing magnificent views of the valleys and surrounding snow-capped Alps. The house was heated electrically, the coils being recessed in the walls. Power is brought up the mountain on a transmission line, but a tunnel off the parking area houses a fine standby diesel-electric generating plant that can be used in an emergency.

One can think only of the waste of engineering talent, construction labor and vast sums of money caused by the building of this monstrosity.

In the meantime, Bavaria is currently concerned with things of greater importance than these evidences of its recent unsavory past. It has to produce 80 percent of Germany's hydro power, and is the granary of the U. S. and British zones. The power is being supplied, but the farmers are not cooperating too well in helping to feed the factory workers and the miners. General Clay has threatened to use troops to locate hidden food stores whose existence is indicated by the numerous passengers on trains from the Ruhr who carry pitchforks, hoes and other farming tools southward and return with mysterious sacks.

China suspends work on Yangtze Dam

The national government of China has cabled the Bureau of Reclamation to stop the preparation of plans for the huge Yangtze Dam project proposed for the river of that name. The cable says that a letter is following that will explain the reason for suspending work on the project, which was estimated to cost about $1,000,000,000.

The bureau was preparing plans in accordance with a $500,000 contract. The Chinese government had already put up half of this amount and had agreed to supply the remainder when the first payment had been used. Of the amount already supplied only about $100,000 has been spent. H. S. Hsu, the Chinese engineer representing his government at Denver, where the bureau engineers at work on the dam are stationed, hopes to obtain approval to complete those phases of the planning now nearly complete.

Yangtze Dam is planned to form a reservoir 250 miles long with a reservoir capacity of 50,000,000 ac. ft., and would be used to provide power, flood control protection and irrigation water for 10,000,000 acres of land. The structure would be 750 ft. high—24 ft. higher than Hoover Dam—and it would be located in the Yangtze gorge below the town of Ichang. Concrete requirements would total 15,000,000 cu. yd. or 50 percent more than for Grand Coulee Dam. A total power installation of over 10,000,000 kw. is proposed.

The project also calls for revolutionary methods for getting ships past the dam. Details on the two major proposals—one using a lock subjected to a maximum head of about 750 ft. and another proposal calling for the use of a giant gantry crane—are given in *ENR* Feb. 28, 1946, vol. p. 310.

New company to build Tennessee gas pipeline

The East Tennessee Natural Gas Co. has been formed to take over from the Tennessee Natural Gas Lines, Inc., its project to construct a pipe line to serve Chattanooga, Knoxville and intermediate points.

A recently organized company, the Warren Engineering Corp., headed by Lee G. Warren, engineer who directed construction of the Chickamauga and other Tennessee Valley Authority dams, has been retained to do the engineering work, the market survey and the location of the line for the East Tennessee Natural Gas Co.

Dedicate Enders Dam in southwest Nebraska

Ground broken for Benbrook, Tex., dam and bids received for Whitney Dam in same state

Citizens of the Republican River Valley in southwest Nebraska recently held dedication ceremonies at the site of Enders Dam, which is the first of a series of dams that will store waters of the Republican River and its tributaries for use in irrigating the lands of the valley.

Enders Dam, located on Frenchmen's Creek, will be an earthfill structure, 114 ft. high and with a crest length of 13,100 ft. The estimated cost is $4,500,000, about one-half of which sum has been appropriated. It will require three years to complete the work provided the necessary additional appropriations are forthcoming.

This week ground is being broken at the site of the Benbrook Reservoir near Fort Worth, Tex., as Army Engineers begin this key project of a proposed $50,000,000 Trinity River reservoir construction program.

The Benbrook project is designed to control, to the capacity of the Fort Worth levees, the run-off from any rainstorm reasonably to be anticipated over the entire drainage area of 330,000 acres. It also will store some 75,000 ac.ft. of water for domestic, industrial and other useful purposes.

The Galveston, Tex., office of the Corps of Engineers announced that the Standard Paving Co. of Tulsa, Okla., was the low bidder on the first construction work on the $26,000,000 Whitney Dam to be built on the Brazos River near Waco. The bid was $314,414.

The work is to include embankment of about 14,700 lin.ft. on the Whitney side of the dam site. There will be about 14,000 cu.yd. of flexible roadway base; 14,300 cu.yd. of gravel; and 605,000 cu.yd. of fill.

Study to be made for Chesapeake Bay tunnel

Governor Lane of Maryland recently ordered a study made of a Chesapeake Bay tunnel as a possible alternative to the proposed bay bridge across Baltimore harbor.

With the bridge proposal meeting determined opposition from some shipping and port interests, the governor said he had asked Robert M. Reindollar, chairman of the State Roads Commission, for an up-to-date report on the possibilities of a tunnel crossing.

Previous studies of the most practical method of linking the eastern and western shores, Governor Lane said, "resolved into a general concensus that the most feasible is a bridge."

No detailed consideration has been given a tunnel since the last study of a bay crossing was made in 1938.

Additional funds sought for Tampa Bay bridge

Legislative action approving a bill to increase the borrowing capacity of the St. Petersburg, Fla., Port Authority for the purpose of building the bridge-causeway across Tampa Bay between Manatee and Pinellas counties has been completed, but voters of St. Petersburg must ratify the measure.

The bill increases the authority's borrowing power from $10,000,000 to $15,000,000.

FitzGerald named to head topographic engineers

The appointment of Gerald FitzGerald as chief topographic engineer of the Geological Survey, succeeding T. P. Pendleton, was announced June 3.

Mr. FitzGerald's long service with the survey and the War Department began in 1917. Since that time he has been engaged in surveying and mapping activities in the continental United States, Alaska, and the West Indies for the Geological Survey. During World War II, as commanding officer of the aeronautical chart service, he directed world-wide mapping operations.

Pendleton

FitzGerald

Mr. FitzGerald was educated at Seattle College and the University of Washington. After joining the Geological Survey he became a specialist on reconnaissance mapping.

Mr. Pendleton, who retired for reasons of health, was largely responsible for the adoption and development of the photogrammetric process known as the "multiplex" method of topographic mapping. He joined the Geological Survey in 1905 and conducted topographic surveys chiefly in the western United States, then served with the Corps of Engineers from 1918 to 1934.

Contract is awarded for N. & W.'s Bluefield tunnel

The contract for the Norfolk and Western Railway tunnel west of Bluefield, W. Va., (*ENR* June 5, vol. p. 916) has been awarded to Strum and Dillard Construction Co. of Columbus, Ohio. Officials said the work would get underway soon, probably this summer.

The entire improvement and modernization job, lying within one of the busiest districts of the N. & W.'s main line, will cost approximately $12,000,000 and will take three years to complete.

Plan larger quarters for western engineers

Plans are about completed for moving the headquarters of the Western Society of Engineers to three floors of a John Crerar Library building at 84 E. Randolph St., Chicago. The initial move to one floor will be made April 1, 1948, and the society will take possession of the other two floors, after remodeling, during the fall of next year. Direct access will be available from two floors of the new headquarters into the building occupied by the library.

These officers of the society have been inducted: William V. Kahler, vice-president of the Illinois Bell Telephone Co. president; Verne O. McClurg, consulting engineer of Mundie, Jensen & McClurg, architect-engineers, first vice-president, and Gustav Egloff, director of research, Universal Oil Products Co., second vice-president.

New topographic surveys to be made in N. Y. State

New surveys to revise the topographic maps for nine more quadrants of New York state are soon to get under way, according to the state Department of Public Works. Financed by matching budget allocations of $50,000 each from the state and the federal governments, engineers of the United States Geological Survey are expected to begin work on the project soon.

Regions to be remapped are the Utica quadrant, last surveyed in 1896, and one quadrant near Buffalo not remapped since 1905. The remaining seven quadrants are in sections centering on Albany, Cohoes, Troy, Amsterdam, Saratoga, Schuylerville and Schenectady.

The $100,000 for the 1947 survey is a big increase over the normal annual allocation of $12,000. The increase was granted to speed up the work.

HIGHLIGHTS OF MUNICIPAL DEVELOPMENTS

Experts approve Richmond expressways, as New York, Indianapolis consider other means of easing traffic congestion—New offer made for Newark Airport operation—Water supply problems occupy city officials—Plan war memorials

A final and favorable report on the proposed expressway through Richmond, Va., (*ENR* Apr. 3, vol. p. 494) has been made by the Automotive Safety Foundation—which was engaged in an unprecedented action by a local newspaper, the "Times-Dispatch", to investigate all phases of the project.

The engineers' report said: "The proposed Richmond expressway is a practical and economical plan, boldly but soundly conceived, for the solution of many of the city's traffic problems."

This plan is being considered by the streets committee of the city council, after having been proposed by the state highway department last November on the basis of several years' research. Affirmative action by the council before July 1 is necessary to obtain U. S. Bureau of Public Roads funds which have been earmarked for the project.

The main north-south expressway through Richmond is projected as a controlled-access road, built mostly at surface level but partially depressed, to give full separation of grades. Constructed on a right-of-way varying from a minimum of 100 to the desired 300 ft., the highway would consist of two 24-ft. pavement strips, providing for two lanes of traffic in each direction, separated by a central parkway 36 ft. wide over most of the route. All over and underpasses and other structures would be built wide enough to accommodate a third 12-ft. lane on each side.

The roadway would be designed to accommodate vehicle speeds of 50 miles an hour, with a 35-mile design speed at entrances and exits.

It is expected that the expressway project would cost about $25,000,000.

While Richmond's somewhat unorthodox approach to a solution of its traffic problem apparently neared decision, other cities announced elaborate plans for solving their own difficulties.

In New York City, a special traffic committee appointed by Mayor William O'Dwyer submitted to the Board of Estimate an elaborate plan calling for expenditure of about $25,000,000 to finance the purchase and construction of some 33 city-owned and operated parking lots and garages, scattered through the five boroughs that make up the metropolis. Included in the proposals was the suggestion that two underground garages be built, under Bryant and Madison Square parks, in the heart of the Manhattan business and financial districts.

White Plains, N. Y., county seat of suburban Westchester County, meanwhile, saw the appointment of a five-man municipal parking authority to try to solve the city's increasingly severe traffic problem. The authority, headed by Leslie B. Gillie, president of the Common Council, has authority to borrow up to $1,000.000 to finance acquisition or construction of municipally-operated parking areas.

Indianapolis, Ind., concluding a year-long study of means of speeding traffic flow, decided to make permanent restrictions against parking on five downtown streets during business hours; and was considering permanent establishment of one-way streets and the elimination of all left-hand turns.

CITY TO DRINK DEEP

Citizens of Rockford, Ill., expect to get 2,500 gal. of drinking water a minute from a stream 250 ft. underground.

Well drillers have completed a test hole upon the recommendation of geologists who said that the old "Rock River," a glacial stream buried half a million years ago, is still rolling along.

If complete reports bear out the preliminary findings, a new well to be known as unit well No. 7-A will be drilled near the test hole. The city already has a well, Unit No. 9, which has a capacity of 1,800 gpm.

Seek Newark Airport

Seeking to bring the Newark, N. J., municipal airport into a coordinated system for operation with the two New York City Airports recently leased, the Port of New York Authority last week offered the city an estimated rental of $38,589,000 in return for a 50-year lease on the airport and on the facilities of the Port of Newark.

The Port Authority—a bi-state entity which was formed originally to operate the Holland Tunnel, the George Washington Bridge and similar utilities—took over active operation of La-Guardia Field, Floyd Bennett Field and Idlewild Airport (still under construction) from New York City, under a similar 50-year leasing agreement (*ENR* April 3, vol. p. 490). An original offer to Newark officials, based on a 90-year lease (*ENR* Aug. 8, 1946, vol. p. 19) was rejected.

If granted the Newark lease, the authority will expand the airport 800 acres, and construct new runways and buildings on the present site.

Memorials Planned

Members of the Omaha, Neb., Auditorium Commission recently completed an air tour of Houston, Kansas City, Oklahoma City, San Antonio and New Orleans to accumulate data relative to the proposed construction in Omaha of a $3,500,000 auditorium and exhibit hall.

Other cities also pushed their plans for memorial structures. These included Indianapolis, Ind., where trustees for the Indiana World Memorial Plaza found bids to be far in excess of the $2,500,000 state appropriation for the construction of two American Legion buildings on the site. Three bids all exceeded $4,000,000. The trustees said they would discuss the bids with Gov. Ralph F. Gates, and added that the appropriation might be used in constructing one of the new buildings instead of both.

At Milwaukee, Wis., the county highway committee announced the appointment of the Osborn Engineering Co., Cleveland, Ohio, to make a survey of possible sites for a new public stadium.

Water Problems

Increasing the water supply available for growing populations and spreading business areas concerned many cities. Developments included:

Denver, Colo., voters approved a $23,000,000 bond issue to expand the city water system; Gatlinburg, Tenn., received bids on a proposed $620,000 water and sewerage system; the Niagara Falls, N. Y. City Council received a resolution to authorize a $750,000 extension of water intakes; the Ohio legislature approved a bill to permit the Cleveland superintendent of public works to construct a new break-water and crib in Lake Erie off the site of the proposed Nottingham Reservoir; Anderson, Ind., began work on installation of an underground supply.

At Phoenix, Ariz., city councilmen were warned by engineers that the city faces an increase in fire insurance rates and that many new homes will be without water service unless some action is taken to increase supply.

OBITUARY

Ulysses B. Hough, 83, civil engineer and contractor of Spokane, Wash., died there May 28, where he had lived most of his life and was city engineer in 1893. He built the first unit of what is now a great smelter at Trail, B. C., and laid out the railroad from there to Rossland. Mr. Hough spent six years with the Bunker Hill Co., supervising construction of the Kellogg, Ida., tunnel and acting as construction engineer on the mill. In later years, until his retirement in 1932, he had been engaged in building flumes for logging.

Burton W. Rosekrans, 69, civil engineer who retired from the New York State Department of Public Works in 1944, died in Albany, May 31. He received his engineering education at Cornell University. Starting in 1900, Mr. Rosekrans spent 44 years as an engineer with the state.

Arthur Robert Hughes, 58, a civil engineer at the Patuxtent Naval Base, for several years, died recently in Chevy Chase, Md.

Edwin C. Ball, 60, engineer for the Petroleum Heat & Power Co., Boston, Mass., died May 31. He was graduated from Massachusetts Institute of Technology in 1908.

William Harper, 67, engineer of Kenmore, N. Y., who was active in civic affairs for many years, died recently.

Thomas Franklin Beltz, 71, retired civil engineer, died at Clearwater, Fla., May 22. He was one of the first engineers to work on the Panama Canal, where he spent four years. He also worked three years on the projected Nicaraguan canal. After that, he built railroads in the southwestern United States and then became engineer for the Universal Concrete Pipe Co., Waco, Tex., retiring in 1934. He was a graduate of the University of Pennsylvania.

D. M. Rickenbaker, 52, of Union, S. C., engineer and road building contractor died May 29.

J. Marion Grainger, 43, of Raleigh and Louisburg, N. C., principal engineer of the North Carolina State Rural Electrification Authority, died June 2. He was educated at the University of North Carolina and at Georgia Tech.

Fred V. Shampine, retired contractor and engineer of Green Cove Springs and Jacksonville, Fla., died May 31. He was the government engineer for the construction of Camp Blending.

Robert Y. Peck, 41, T. and P. Construction Co., Concord, N. C., died June 2. He was with the State Highway Commission for 23 years.

George Samuel Wilson, 66, University of Washington mechanical engineering professor and member of the faculty for 41 years, died June 2 at Seattle, Wash. Graduated from the University of Nebraska, he joined the University of Washington staff as an instructor in 1906 and a full professor in 1924.

Freeman fund to aid hydraulic study

The Freeman Fund Committee of the Boston, Mass., Society of Civil Engineers, up to July 15, 1947, will receive application for a year's scholarship to be devoted to study or research in hydraulics or an allied science. The stipend for tuition, traveling and living expenses, allows $3,000 for a single man or $3,600 for a married man.

Candidates must be American citizens, not under 24 years of age, and graduates of a technical school of recognized standing. Preference will be given to residents of New England and eastern New York outside New York City. Membership in the Boston Society is desirable though not required. Further details may be obtained from Edwin B. Cobb, secretary of the society, 715 Tremont Temple, Boston, 8, Mass. Howard M. Turner, Boston consulting engineer, is chairman of the Freeman Fund.

MAJOR MEETINGS

American Society for Testing Materials, 50th annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 16-20.

American Society for Engineering Education, annual meeting, University of Minnesota, Minneapolis, Minn., June 17-21.

President's Highway Safety Conference, Action Program group, Auditorium, Department of the Interior, Washington, D. C., June 18-20.

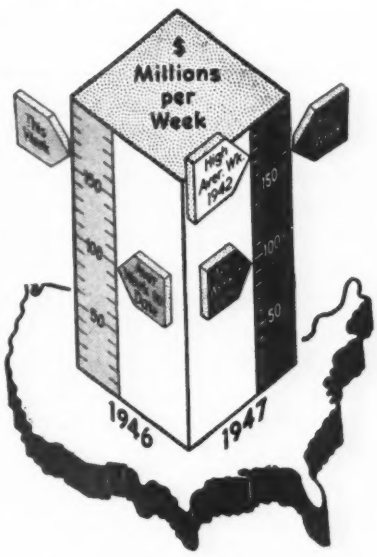
Midwest Flood Control Conference, Hotel Severin, Indianapolis, Ind., June 18-20.

American Water Works Association, 67th annual conference, jointly with Federation of Sewage Works Association, 20th annual meeting, Civic Auditorium, San Francisco, Calif., July 21-25.

Federation of Sewage Works Associations, jointly with American Water Works Association. See above.

American Congress on Surveying and Mapping, 7th annual meeting, Statler Hotel, Washington, D. C., August 14-15.

CONSTRUCTION ACTIVITY



As Reported this week to ... *Engineering News-Record*

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of June 12 1947	Cumulative 1947 (24 wks.)	Cumulative 1946 (24 wks.)
Federal	$25,958	$284,885	$280,212
State & Mun.	40,201	719,545	581,829
Total Public	$66,159	$1,004,430	$862,041
Total Private	91,981	1,431,477	1,535,755
U. S. Total	$158,140	$2,435,907	$2,397,796

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1947 (24 wks.)	Cumulative 1946 (24 wks.)
Waterworks	$1,030	$52,018	$43,721
Sewerage	5,403	53,090	42,198
Bridges	5,218	75,061	55,483
Highways	18,665	337,340	330,360
Earthwork, Waterways	2,279	131,217	171,831
Buildings, Public	14,081	230,885	145,956
Industrial	8,357	355,167	492,040
Commercial	61,402	858,792	938,795
Unclassified	41,705	342,337	177,412

NOTE: Minimum size projects included are: Waterworks and waterway projects, $22,500; other public works, $40,000; industrial buildings, $55,000; other buildings, $205,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1947 (24 wks.)	Cumulative 1946 (24 wks.)
NON-FEDERAL	$797,034	$478,844
Corporate Securities	313,679	189,395
State and Municipal	483,355	289,449
FEDERAL		158,320
Total Capital	$797,034	$637,164

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost	June '47	403.29	193.86
Building Cost	June '47	303.14	163.87
Volume	May '47	224	98

EDITORIALS

VOLUME 138 NUMBER 24

June 12, 1947

Buildings Can Be Firesafe!

EXPERTS on fire prevention apparently agree that building designers are responsible for serious fires. In this issue, Prof. John J. Ahern of the Illinois Institute of Technology points out that sufficient knowledge, suitable materials and adequate construction techniques are available to make buildings firesafe. This opinion was also advanced by a special committee reporting to President Truman's recent fire-prevention conference (*ENR* May 15, vol. p. 798), which also pointed out that fire safety begins in the designer's office. Incorporation of the proper features thus becomes a responsibility of the designer. It can be expected that on occasion an architect or engineer might become negligent and overlook a fire-safety requirement. To minimize such possibilities the technical societies can be of great service. By frequent inclusion in their meetings of discussions on design for fire safety, they can act to remind designers of their obligation.

Radio for Highway Work

SHORT-WAVE RADIO communication systems have proved to be an effective means for improving the efficiency of highway maintenance forces in the few limited experimental installations that have been made. Because this use of radio appeared to have possibilities, the American Association of State Highway Officials asked for, and has now received, an allocation of certain radio bands that could be used for further experimental study (*ENR* June 5, vol. p. 916). Thus every state highway department is being given an opportunity to make a test installation of short-wave communication between field crews and head offices or district supervisors. If enough states undertake to make such test installations, the Federal Communications Commission is ready to make the allocation of radio bands permanent. Hence the success or failure of this attempt of the AASHO to provide highway departments with a new service facility depends on prompt response from a considerable number of states. Here is an opportunity that should not be lost for lack of quick action. In the northern states especially, where winter storms can quickly isolate snowplows and work crews, it would appear that the cost of the radio equipment might be saved in one season.

Planning to Avoid Difficulty

BROOKLYN-BATTERY TUNNEL construction in New York City has been characterized more by avoiding difficulties than by heroic methods to overcome troubles that have occurred. For this condition the planners of the tunnel route should be accorded first credit. Subsurface investigations were adequate to disclose conditions beneath the water and the ground. The tunnel line was adjusted, insofar as was economically practical, to avoid most construction hazards. Tube design followed details found adequate on Queens-Midtown and earlier vehicular tunnels. The contractors also have employed proven practices in construction. For example, shields are being used to pass through a narrow gorge in the rock as well as in the rock tunnel sections for final enlargement and setting of light steel lining. Similar safe practices have been used on the mixed-ground tunneling from the Brooklyn end; notable among these is the horizontal radial drainage system used to lower the groundwater and thus eliminate or reduce use of pressure air. Sound practices have made this tunnel job a safe, if not spectacular, operation.

Data for Footing Design

TIME-CONSUMING ANALYSES and hiring of expensive consultants for the design of footings for most small buildings are impractical. Yet, as pointed out elsewhere in this issue, these services cannot always be dispensed with wisely by assumption of a liberal factor of safety. Perhaps, more information needs to be obtained by research. Or, maybe, data already available requires presentation in a form that most designers can use. In any event, there is a job still to be done to simplify the application of soil mechanics theory to design.

Maintaining South American Ties

PRESENT EMPHASIS on strengthening ties with South America through exchange of military materiel and know-how should not distract attention from a program of cooperative effort that has had a profound influence in promoting better hemispheric relations. That program—initiated in 1942 as an undertaking of the Office of Coordinator

of Inter-American Affairs—will terminate unless the Congress acts at this session to extend it.

Based on the premise that only as people are helped to help themselves can there be a sound development of higher living standards, a major part of the program of the Coordinator's office was devoted toward sharing know-how in public health and sanitation. This was done by means of demonstration projects financed in part by the United States and the participating countries. Contracts were made with 18 Latin American republics, and in the period 1942-48 a total of $66 million will have been spent by the United States. Probably no money that we have ever spent in foreign countries has done more to promote the "good neighbor policy." To the vast masses of common people in Latin America who have benefited from these cooperative efforts in furthering public health and sanitation, our role as a "good neighbor" is no mere abstraction.

Continuance of this cooperative program beyond 1948 is possible at a cost of probably not more than $5 million annually. Compared to what we may be asked to spend on other foreign commitments to promote a way of life that we consider essential to world peace, it is a small sum. Realistic appraisal would indicate that the Congress would be well-advised to act now in continuing the Institute of Inter-American Affairs. No money need be appropriated because sufficient funds are available to carry on the work until 1948. However, if no intention is shown now that the organization will be continued, a staff that has done much with little will disintegrate.

No Federal Pollution Control

IN RETURN for surrender of pollution-abatement control to the federal government it would seem that the 48 states have the following alternatives: If they relinquish their sovereign rights to the Federal Security Administrator, they might get grants-in-aid of $100 million; but if they get behind another proposal sponsored by the Federal Works Agency, which would put federal control of pollution abatement in the hands of both the FSA and the FWA, they might get $150 million yearly (*ENR* May 22, vol. p. 847). This seems to be the major conclusion to be drawn from current legislative developments to put the federal government in control of pollution-abatement activities. State sanitary agencies and the cause they serve have much to lose by surrendering established prerogatives to a federal bureau.

What can federal agencies hope to achieve in reducing domestic and industrial waste pollution that is not already being done by state agencies? Curtailment of stream pollution is not accomplished by fiat or by the wave of a wand in Washington. It is the result of local public support coupled with progress in the development of appropriate treatment processes. Both of these things take time, and happily great strides forward have been made. Prior to the war, and even during the conflict, the people of this nation evidenced their increasing appreciation of the need for pollution abatement by favorable local action on bond issues authorizing construction of remedial works. Industries, too, show an increasing sense of responsibility for pollution control, and progress is being made in accordance with advances in treatment methods.

A factual measure of this progress is shown by *Engineering News-Record* surveys made in 1938 and 1946: More than 1,000 new municipal treatment plants and 343 industrial wastes plants were added in this period—all of this at a time when war production demands, not pollution abatement, challenged the nation. Furthermore, present activity as measured by dollar volume of work underway indicates that this year more than $100 million of sewage disposal improvements will be built; and the backlog of proposed projects already totals more than $2 billion. Who can say, therefore, that state agencies have been impotent in the promotion of stream pollution abatement?

It is gratifying to note from repeated news reports in this journal that spokesmen for state agencies are becoming more articulate in exposing the worthlessness of federal legislation for expediting stream-pollution control. Among other things they properly point out that federal intervention coupled with grants-in-aid could add little more than confusion and needless expense to what is primarily a matter for local solution and financing. For more than half a century bills introduced in the Congress for federal control of stream pollution have been defeated. The currently proposed legislation deserves the same treatment.

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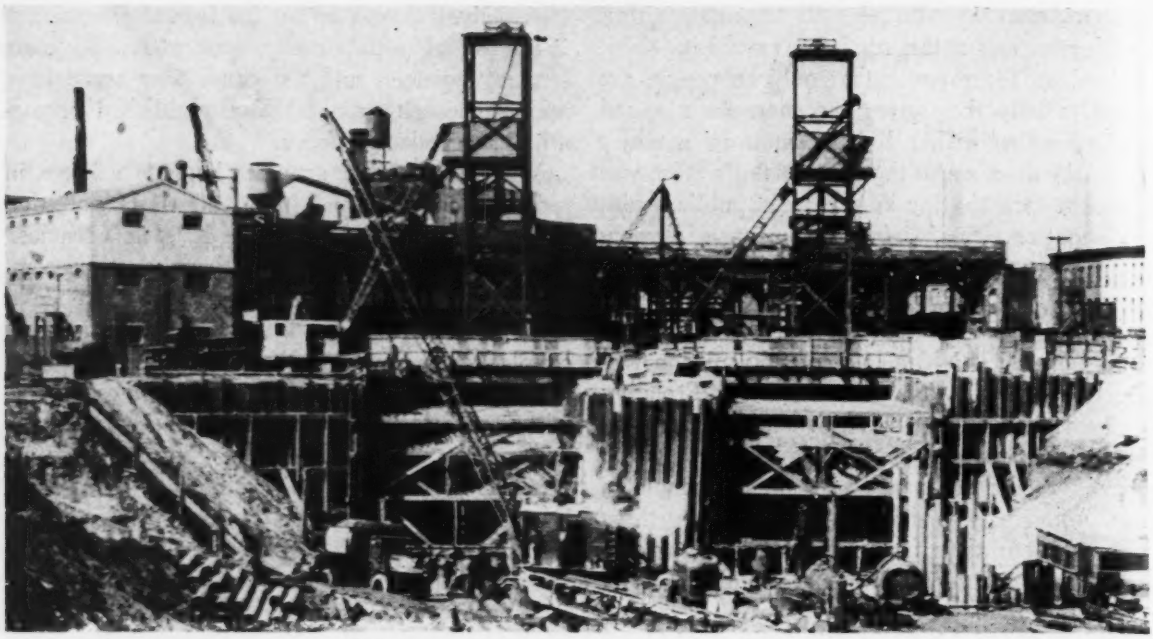

Fig. 1. Brooklyn approach to the twin-tube vehicular tunnel under construction between Brooklyn and Manhattan.

Brooklyn-Battery Tunnel in New York City

Contents in Brief: *Soft ground and mixed-faced tunneling has been completed as well as most of the rock excavation for the Brooklyn-Battery Tunnel. Installing cast-iron lining in the rock section is now underway, with concrete lining scheduled for next year and completion of the tunnel for 1949. The soft-ground end of the tunnel was drained by horizontal radial pipes to permit considerable normally subaqueous work to be done in free air and to reduce the amount of air pressure required for much of the remaining excavation. Rock tunneling was done by a pioneer drift with enlargement to full face done working toward the shaft.*

THE BROOKLYN-BATTERY Tunnel under the East River in New York City has been advanced to near the "holing through" stage and completion is expected in 1949. A vehicular facility, the tunnel will connect existing and proposed express highways in Brooklyn with the West Side Express Highway and downtown Manhattan at Battery Park.

Two lanes of traffic will be accommodated in each of two 31-ft. dia. tubes driven under the river simultaneously but separately. The tubes, including cut and cover approach sections, have a length of 9,117 ft. portal to portal, passing under the main channel and a side channel of the East River. The tunnel line passes near the northeasterly tip of Governors Island, and here an intermediate ventilation shaft is being constructed but no provision is made for vehicular access to the island. Other ventilation structures are located near each portal.

The tunnel has a smooth direct alignment in a generally north and south direction following the line of Hamilton Ave. into Brooklyn where it connects with the Gowanus elevated parkway for direct access to the southern part of the borough and to the Long Island express highway and parkway system. In Manhattan it will have unrestricted access to both East and West side express highways and to Hudson River crossings to New Jersey and the west.

Planning for a vehicle tunnel under East River from Brooklyn to lower Manhattan dates back into the Twenties when traffic congestion became serious on the existing Brooklyn, Manhattan and Williamsburg bridges. A bridge also was proposed. The question of tunnel or bridge was settled when the U. S. War Department, which has jurisdiction over navigable waters, refused permission for construction of a bridge.

Rock and soft ground

As may be seen in Fig. 3, much of the tunnel is in rock in a formation known as Manhattan schist. With the exception of a short section in the vicinity of the Battery Park shoreline where there is a gorge extending to about the level of the tunnel invert, the rock cover is adequate for full tunnel section to well beyond Governors Island.

From that point the rock dips. Under Buttermilk Channel and be-

yond to the Brooklyn portal the tunnel is in soft ground, which consists of stratified silt and clay under the water and stratified sand and gravel with some clay and boulders from the shoreline to the Brooklyn portal.

The rock tunnel section is about 4,900 ft. in length while the soft-ground and mixed-face section requiring shield protection for driving is about 2,800 ft.

Depth of the tunnel at the pierhead lines is fixed by the U. S. War Department to maintain full channel depth. Shoreward from the pierhead lines the grades in the tunnel are a maximum of 3.7 percent ascending and 4 percent descending to reach the surface in the shortest practicable distance. Between the pierhead lines the elevation of the tunnel was made the maximum that would provide adequate rock cover for the greatest length and keep the length of tunnel required to be driven under compressed air to a minimum.

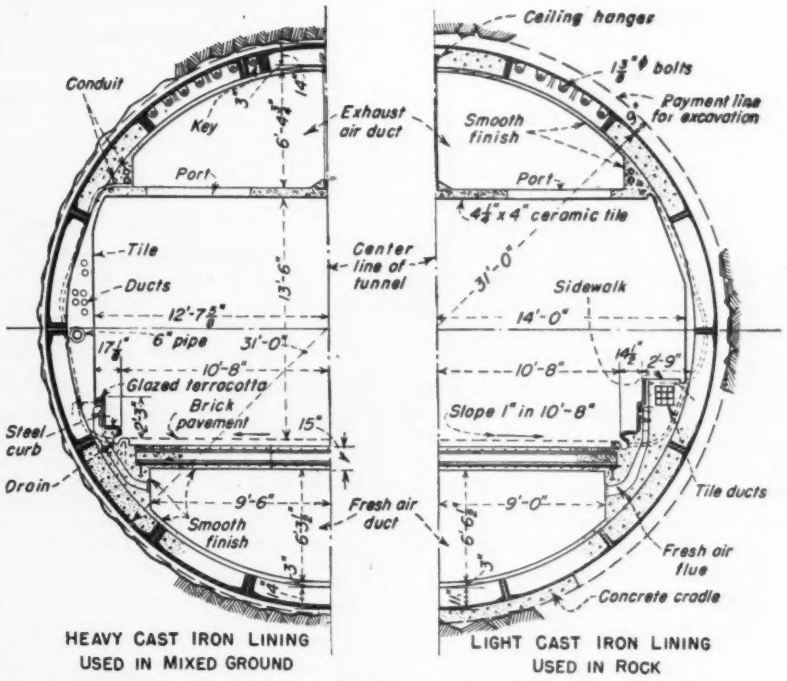

Fig. 2. Each of the twin-tubes will accommodate two lanes of traffic in one direction. The two types of lining are shown here.

Depths between pierhead lines are otherwise kept as high as practicable to minimize grades, depth of the shaft at Governors Island and the air pressure required for tunneling under Buttermilk Channel. The low point of the rock on the tunnel line is at the ventilation structure at Governors Island where the roadway dips to 115 ft. below mean high tide. This is 18 ft. lower than any other vehicular tunnel in the New York area.

The tunnel will be cast-iron lined for its full length between construction shafts. Lining is similar to that used on the Queens-Midtown tunnel, *ENR*, Dec. 21, 1939, vol. p. 830 and Jan. 4, 1940, vol. p. 29. Each ring of lining is made up of fourteen cast-iron segments and a key. A ring length of 31-in.—first adopted for the Queens-Midtown Tunnel to reduce caulking, number of bolts and shield shoves—is being used for the Brooklyn-Battery Tunnel.

In soft ground and mixed-face, heavy cast-iron lining is used with 14 in. flanges, which weighs 22.7 tons per ring and is held by 1¾-in. bolts. Selected on a basis of competitive bidding, with welded structural steel as the alternate, cast-iron lining with 11-in. flanges, 1⅜-in. bolts and a weight of 12.5 tons per ring will be used through the full length of the rock section. Machine bolting is required for the light sections with a bolt tension of 30,000 psi. specified for both heavy and light lining.

Heavy cast-iron lining is caulked with lead wire. As a further precaution against leakage in the rock sections, lined with light cast iron, an asphalt impregnated cotton gasket is placed and caulked in the caulking groove prior to the placing the lead wire. Inside the tubes, concrete will be placed so as to provide a nominal minimum cover of 2 in. over the flange of the cast-iron lining.

A 21-ft. 4-in. wide roadway in each tube will carry two lanes of traffic in one direction and will have headroom of 13 ft. 6 in. Walls and ceiling will be lined with ceramic tile and the roadways are to be paved with brick.

Fresh air will be brought in through ducts under the roadway and distributed from flues just above curb

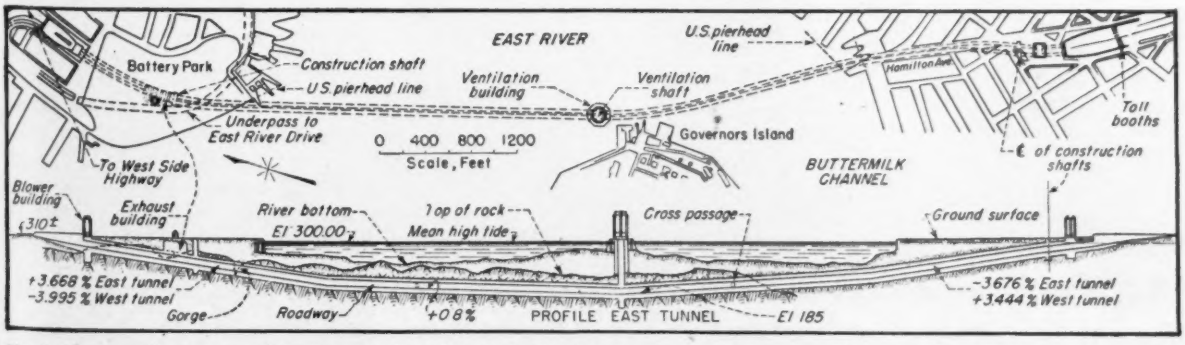

Fig. 3. The tunnel has a smooth alignment in a North-South direction and a maximum grade ascending of just under 4 percent.

level at each side of the roadway. Exhuast ports in the ceiling allow vitiated air to be drawn into air ducts above the roadway.

Ventilation of the tunnel is made positive by 27 blower fans and 26 exhaust fans designed to provide as much as 4,200,000 cfm., or 42 complete changes of air per hour. Location of the ventilation structures is shown in Fig. 3. There will be eight blower and six exhaust fans in the ventilation building at the Brooklyn end and twelve fans of each type at Governors Island. At Battery Park, eight fans located in an underground structure near the waters edge will dispose of exhaust air while seven blowers in a separate intake building will force air into the tubes.

Fluorescent lighting will be used for the tunnel, being the first major installation of its kind. The first cost is no greater than for incandescent lighting and substantial economies are expected in operation. It is expected that fluorescent lighting will be better in quality and continuity, and its intensity can be varied more easily than with incandescent lighting. Intensity at the portals will be high in the daytime to provide a gradual change from daylight to tunnel illumination to alleviate the blinding effect of a sudden change.

Construction halted by war

The project was started by sinking of tunnel construction shafts in Brooklyn in October, 1940, with completion of the tunnel then expected in 1944. Almost from the inception of major contracts the work was slowed, and finally stopped, by more essential activities in preparation for and prosecution of World War II. Work was resumed in November, 1945, and will be completed in 1949.

The plans for the tunnel and the early work on construction were handled by the New York City Tunnel Authority. During the time of shutdown of the work the New York City Tunnel Authority and the Triborough Bridge Authority were combined as the Triborough Bridge and Tunnel Auth rity and that agency is now in charge of construction.

It was planned to let the tunnel excavation in three contracts: (1) the soft-ground section from the Brooklyn construction shafts for a length of some 3,200 ft. into full rock cover; (2) the rock section from Battery Park for about 2,800 ft.; and (3) the Governors Island shaft and tunnel excavation for some 850 ft. each way from it.

The heavy lining for the soft-ground section was ordered soon after construction of the tunnel was authorized and much of the lining was manufactured before war-time priorities halted further work. The tunnel contracts from Brooklyn and Manhattan were let and work was started prior to the beginning of the war. The Governors Island shaft, with short tunnel sections, was being advertised for bids when the attack on Pearl Harbor put a stop to civil awards. But use of material already available permitted driving of the tunnel sections under existing contract during the early part of the war hence some work continued for several months.

Tunnel excavation advanced sufficiently so that when work was resumed time could be saved by extending each of the tunneling contracts to the central ventilation shaft and eliminating tunnel excavation from the central shaft.

Major Contracts, Brooklyn-Battery Tunnel, To Date

General Contractors	Description	Estimated cost	Status
Andrew Catapano	Brooklyn shafts	$239,000	Completed
A. DeAngelo & Sons, Inc.	Manhattan shaft	199,000	Completed
Bethlehem Steel Co	Tunnel lining, heavy	3,225,000	
George H. Flinn Corp.	Tunnel, from Brooklyn	16,700,000	Soft-ground tunneling complete Rock tunneling in progress
Mason & Hanger Co., Inc.	Tunnel, from Manhattan	16,350,000	Excavation nearly complete, lining underway
Grow Construction Co.	Governors Is. Shaft	3,595,000	Shaft sinking underway
E. W. Folley Associates Co., Inc.	Brooklyn Land section*	2,474,000	In progress
Gull Contracting Co., Inc. and L. G. DeFelice & Sons, Inc.	Manhattan land section*	3,889,000	In progress
J. Weinstein, Inc. & Jos. Weinstein	Brooklyn ventilating building	867,000	
L. I. Waldman	Same, electrical	123,000	
B. F. Sturtevant Co.	Fans, Motors and Transmission	829,920	
United States Quarry Tile Co.	Ceiling Tile	192,215	
General Electric Co.	Switchboards	990,912	
Westinghouse Electric Co.	Transformers	33,785	

*(Additional approach work has been contracted by other agencies).

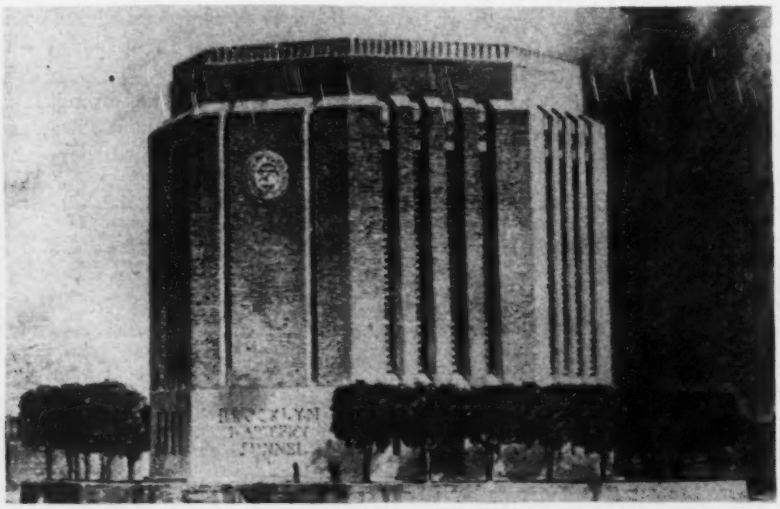

Fig. 4. Ventilation for the mid-section of the tunnel is to be provided by fans housed in a tower above the shaft near Governors Island.

All of the main contracts now are under way except that for the Manhattan Plaza. From the Manhattan end, 24x24 ft. bottom drift was driven some 4,000 ft. to the end of the extended contract, 100 ft. beyond the central ventilation shaft. The tubes were enlarged, working back toward the construction shafts on land. The section at the gorge in the rock was passed originally in a small drift driven under compressed air and is being enlarged by constructing shields in each tube, which are moving ahead under compressed air. The shields are to be used the full length of the contract for possibly needed protection and to erect the light cast-iron lining. Pressure air probably will be required in each tube for only 150 ft. of the total length of 3,900 ft. in the contract.

Shields driven 2,000 ft. in soft ground and 400 ft. in mixed face from the Brooklyn end reached full rock cover in March of this year. The shields were left at the start of good rock while bottom drifts were advanced in both tubes to connect with the excavation carried on from Manhattan. Holing-through of both tubes is expected this summer.

Shaft at Governors Island

A made island off the shore of Governors Island serves as the location for the central ventilating shaft. Silt and miscellaneous material was dredged to a depth of 55 ft. and refilled with clay and sand, protected by riprap surmounted by a bulkhead on piles. The ventilating equipment is to be installed in an octagonal building, 125 ft. across and 120 ft. high, supported around the periphery on ten 5 ft. 6 in. dia. caissons sunk to rock, which are now completed. In the center a 51 x 111 ft. shaft is now being sunk through the overlying material some 90 ft. to rock.

Original estimate $80,000,000

The tunnel project, with some highway connections and real estate to be provided by the New York City, was estimated in 1939 to cost $80,000,000. The two tubes, plazas and appurtenances, exclusive of real estate and highway connections, were financed with a loan from the Reconstruction Finance Corporation of $57,000,000 at a 3½ percent interest rate. The loan is to be repaid from tolls over a fifty-year period.

Money for right-of-way and connecting highways is being supplied by New York City agencies.

TUNNELING FROM MANHATTAN IN ROCK

Shallow rock cover over the tunnel influenced greatly the procedure followed in driving the two tubes of the Brooklyn-Battery Tunnel from the Manhattan end. The alignment was set sufficiently deep to have presumably a minimum of 10 ft. of rock above the excavation line. The rock is the weak and somewhat irregular micaceous formation known as Manhattan schist. In some areas there is additional protection from compacted overburden, but at the main ship channel submarine blasting had been done some years ago to clear to a depth of 45 ft., possibly affecting the rock structure.

A deep gorge in the rock extends to the tunnel invert, crossing both tubes at a slight angle some 400 ft. from the construction shafts and near the shore line of Battery Park. The gorge is filled with water-bearing glacial deposits which had to be penetrated by the tunnels.

Prudence dictated that the tunnel should be driven with a minimum disturbance of the rock cover and by a method that would permit passing the gorge expeditiously. The plan evolved by the contractors, Mason & Hanger Co., was to drive a 24x24-ft. pioneer bottom drift for the full length of the contract then enlarge to the full diameter required. Driving the pioneer heading gave the security of added cover when doing the heavy blasting of face excavation. When enlarging to full size, the rock was less confined and blasting could be lighter, thus holding to a minimum the disturbance to the rock cover. Where questionable rock was encountered the pioneer drift was made smaller to leave more top cover and expose less arch. Use of compressed

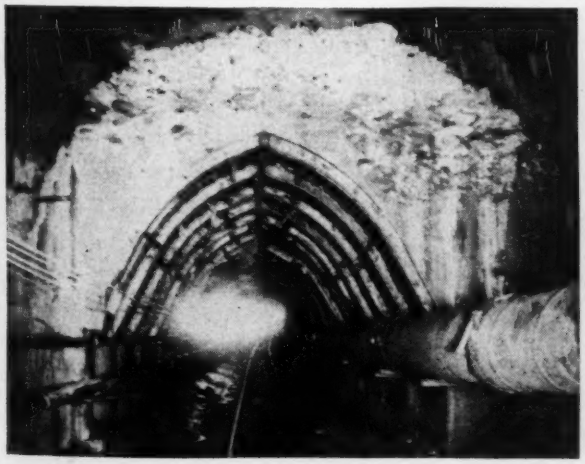

Fig. 5. Passing the gorge in the rock was done by working under air pressure to drive a 13-ft. high drift through the bad ground. Enlargement of this section was the principal reason for later use of the shield.

Fig. 6. Tunnel invert ready for cradle concrete. Track was supported on U-bolts around pins in the rock and served as the screed for striking off the concrete. Roof support was required in only a few places.

air was necessary for driving the drift at the gorge.

An important part of the plan for excavation is the use of shields in each tube to (1) pass the rock gorge with the soft-ground equipment best applicable to such materials (2) complete excavation in questionable rock areas with a minimum of danger from falling rock, (3) set the cast-iron liner rings from an arm on the rear of the shield.

Driving operations

From the construction shaft, rock excavation was started for the bottom drift with blast holes drilled from a small jumbo. Shooting was done with delay exploders; mucking was handled with a tunnel shovel that forced into the rock then tilted up to feed onto a belt conveyor for delivery to 5-cu. yd. side-dump muck cars. At the shaft, rock was transferred through a hopper to "battleship" buckets, hoisted by a stiffleg derrick over each tube and dumped into a bin for subsequent truck haul to a disposal area.

When excavation was some 350 ft. from the shaft and soft ground of the gorge was known to be just ahead, a concrete bulkhead, with airlocks and appurtenances, was built across each tube and air presure was put on. Wall-plate drifts about 8 ft. high and 9 ft. wide on each side of a 20x20-ft. excavation were driven 73 ft. ahead to beyond bad ground. Soft ground was supported on poling boards that were driven over the caps and outside of the supports of the timber bents. Concrete wall-plate benches were placed for the length of the drifts.

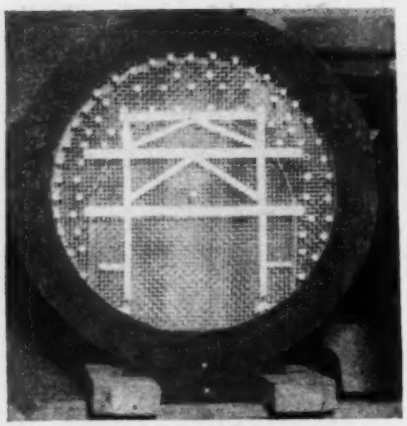

Fig. 7. Drill pattern for enlargement of drift to full 31 ft.-dia. size. Numbers on the heads of the pins show the delay rotation in blasting.

The center section was next excavated to give a finished height of about 12 ft. with the roof carried on liner plates on semi-circular I-beams set on the wall plates and concrete placed to serve as positive protection. The invert was mucked out and a concrete cradle placed through it to the shape of the bottom of the shield to be used for full size enlargement.

Once past the gorge, work was continued in free-air with the pioneer drift enlarged as rapidly as possible to 24x24 ft. The top was cut to a 12 ft. radius and the bottom to an arc that would permit placing a shallow cradle to a 31-ft. inside diameter to carry the shield.

Little difficulty was experienced in driving the rest of the length of the pilot tunnels. A cherry-picker straddled the hauling track near the loader to lift an empty car while a filled one was pulled out beneath it. A 12-ton storage-battery locomotive hauled two cars and was assisted by a second locomotive on the 3.9 percent grade approaching the construction shaft.

Work in the tunnel was shut down from December, 1942, until November, 1945. Equipment and wiring all were removed but piping was left in place and the tubes allowed to fill with water. The light gage ventilation pipe rusted badly and rock fell from one seam but there was little other deterioration. When work was resumed, the first operation was to complete the driving of the 24x24 ft. bottom drift to just beyond the Governors Island shaft.

A concrete cradle across the bottom 60 deg. of the 31 ft. 8 in. dia. circle of the outside of the shield was the next requirement. The invert was cleaned, working toward the shaft, by taking up the hauling track rails, dragging the muck by scraper to a belt conveyor loader that filled the cars. The track, attached to steel mine ties, was aligned by fastening to U-bolts around pins doweled into the rock and then blocked up to carry trains. Side-dump cars were run over this track to deliver concrete mixed on the surface. The rails served as the guide for a heavy steel screed that shaped the bottom of the

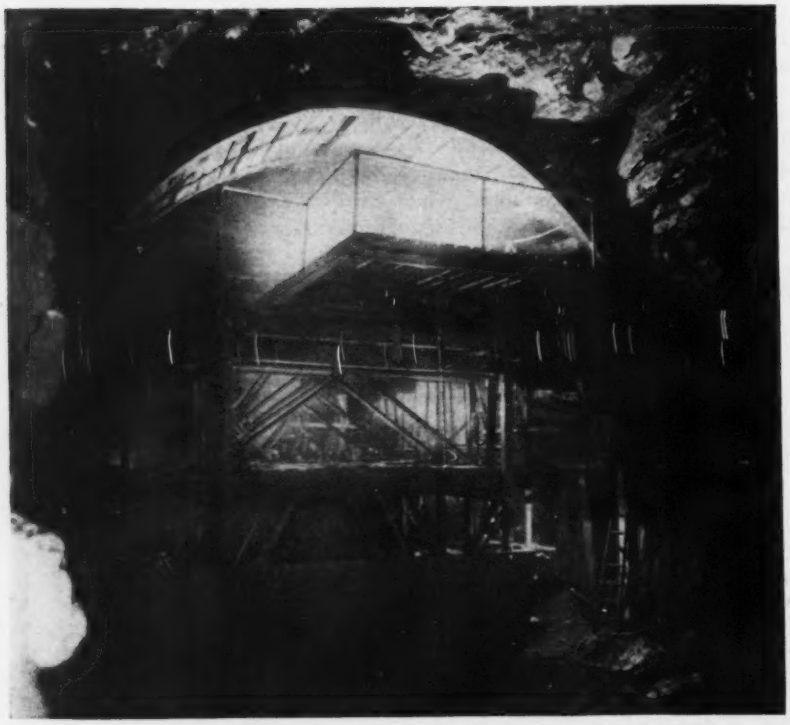

Fig. 8. Enlargement was done working toward the portal so that the loader did not have a wall to work against. The movable blast plate on the front of the drill carriage solved that problem while a retractable platform at the top of the carriage gave extra reach in scaling.

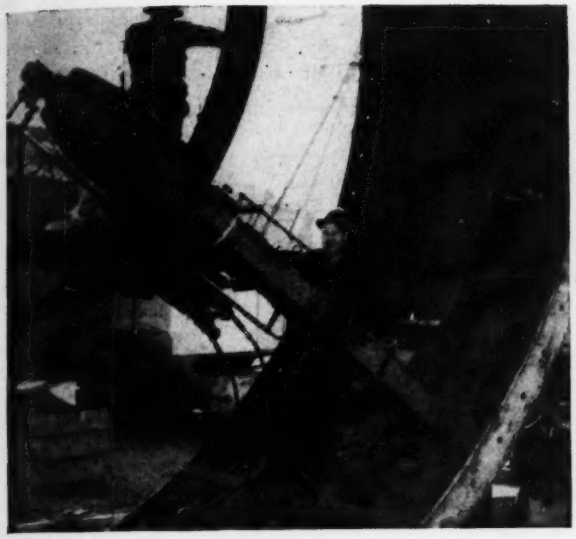

Fig. 9. A pneumatic powered bolt tightener pulled the 1⅜-in. bolts up to 30,000-psi. tension. One of the five tighteners that are mounted on the shield is shown here in experimental use outside the tunnel.

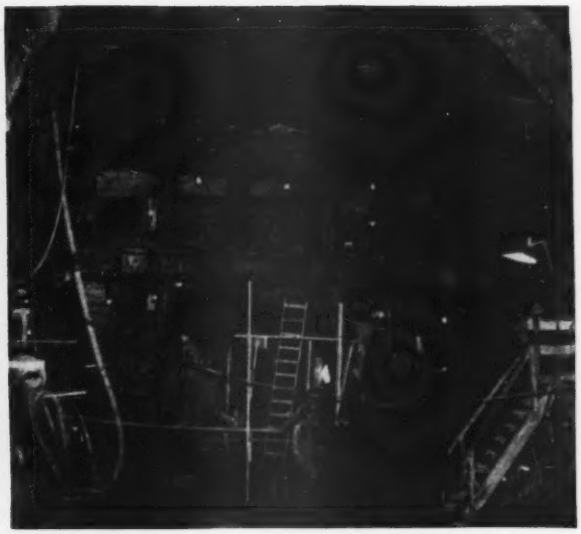

Fig. 10. The forward end of the shield installed at the Manhattan end of the tunnel. It is being used for final enlargement and for setting of the cast iron liner but was required primarily to pass a short gorge in the rock.

MASON & HANGER CONTRACT—ROCK TUNNEL STATISTICS

Pilot Tunnel

(Data shown for 1,100 ft. in each tube, completed after war-time shutdown)

	East Tunnel	West Tunnel
Number of working days	72	88
Average advance per day	15.2 ft.	12.5 ft.
Volume removed per lin. ft.	18.4 cu. yd.	18.1 cu. yd.

Dynamite used — 5.65 lb./cu. yd. of 40% for 19,670 cu. yd.
4.02 lb./cu. yd. of 60% for 20,500 cu. yd.

Tunnel Enlargement

(Data for full 3,600 ft. length of each tube)

Number of working days	187	192
Average advance per day	19.2 ft.	18.8 ft.
Volume removed per lin. ft.	12.6 cu. yd.	12.9 cu. yd.

Dynamite used — 2.7 lb./cu. yd. of 40% for 92,000 cu. yd.

(Additional 12,500 cu. yd. is now being excavated at the gorge)

tunnel, leaving a depression between the rails to permit passage for flanged wheels of hauling equipment.

Enlargement of the tunnel to the full size of the design section was done by working from the end of the contract back toward the portal. A large carriage with ten 3½-in. drifter drills was set up to operate on rails laid on a flat section of concrete at the top of the invert cradle. Some 70 holes were drilled 11 ft. deep, in the pattern shown in Fig. 7 for a 10 ft. advance. Variable delay exploders were used with 2.7 lb. of 40 percent powder per cubic yard. The rock dropped to the invert and did not fly. The average in place measurement of rock removed in the enlargement was 12 cu. yd. per ft.

Picking up the rock from the open

TYPICAL HEADING GANG, EACH TUBE MASON AND HANGER CONTRACT, ROCK WORK IN FREE AIR

Job	Pilot Tunnel	Enlargement
Blaster (heading foreman)	1	1
Drillers	7	10
Drillers helpers	7	10
Powder man	1	1
Nipper	1	2
Mucking machine operator	1	1
Electrician	2	2
Maintenance man	1	1
Motormen	3	3
Derail man	1	1

Serving both tubes

Electrical foreman	1
Maintenance foreman	1
Pumpman	1
Track foreman	1
Driller	1
Helper	1
Laborers	2
Shaft foreman	1
Laborer	1

invert was foreseen to be a problem as nothing would prevent the last of the rock from being pushed down the slope away from the mucker bucket as it attempted to load the rock. A heavy plate was arranged on the shaft side of the drill carriage to serve as buffer for such rock. As the rock did not fly it was possible to leave the carriage only 20 ft. from the blast.

After the enlargement shot, scaling was carefully done. Working first from the cherry-picker, which was on the side of the shot toward which excavation was advancing, the roof was scaled to a point where it was possible to reach the drill carriage. As soon as electric and air connections were restored on the drill carriage, scaling was completed from it, working from a retractable platform that could be extended as much as 26 ft. from the top of the carriage. Rock then was loaded by the mucker, working against the "blast plate" on the drill carriage.

Excavation that could be done conveniently without use of shields now is completed in both tunnels. Shields, with an erector arm on the rear, were erected at the shaft in each of the tubes. They are now setting the light cast-iron lining as they advance. After the shields moved some 350 ft., air pressure, to about 20 psi., was put on to pass the gorge.

After the gorge is passed it is ex-

pected that the shields will be used in free air all the way to the Governors Island shaft, moving on the rails imbedded in the cradle. The tunnels are being enlarged as required in the safety of the steel covering. Lining, nearly all of it lightweight, will be used for the entire remaining length of the contract. It will be set from the erector arm on the rear of the shield. Packing and grouting back of the rings will be carried on simultaneously.

Concrete will not be started until lining is completed, about six months from now. The present plan is to deliver concrete to the tunnel in side-dump cars, using a boom rig to transfer the concrete to forms arranged for the different pours.

TUNNELING FROM BROOKLYN IN MIXED GROUND

Lowering the water table by a system of deep horizontal radial drains permitted setting and starting shields from Brooklyn end of the Brooklyn-Battery Tunnel in free air. This was the outstanding departure from conventional shield-driven tunneling procedure. Continued pumping of the wells made it possible to use air pressure 6 psi. lower than the theoretical even after the shields were well beyond the ends of the horizontal wells. This condition allowed longer working hours when under air pressure and prevented difficulty from air escaping where cover over the shield was very shallow in previous ground.

Some 2,800 ft. of the 9,117 ft. between portals of the tunnel is in sand, gravel, silt and clay that required shield protection and heavy lining for construction. The shield tunneling is being done by George H. Flinn Corp. under a contract that extends to the ventilation shaft at Governors Island and includes about 1,000 ft. of rock tunneling in each tube.

The 31-ft. 8-in. dia. shields used in the two tubes are practically identical with those employed on the Queens-Midtown Tunnel, *ENR*, Jan. 4, 1940, vol. p. 29. Methods of driving are somewhat similar.

Two separate construction shafts were sunk in the fine sand to below the tunnel line, some 40 ft. below the groundwater level. Unwatering of the shaft was accomplished by three pumps of 500, 600 and 1,000-gpm. capacity, respectively, with the assistance of a ring of wellpoints added at the bottom of the shaft. To alleviate, so far as possible, a change in the general groundwater level, the water pumped out was returned to the ground via diffuser pits located about half a mile from the shaft.

Provision for unwatering the shafts was not adequate to permit turning the heading and setting the shield in free air. Impervious silt and clay below the sand made it impractical to unwater further with vertical wells as the space between the impervious strata and the tunnel line was not great enough to permit water drawdown to below the tunnel.

A solution was found in installation of the radial dewatering system mentioned above in which pipes radiate horizontally from the foot of an open shaft. A 11½-ft. inside diameter dewatering shaft was put down to a depth of 80 ft. below the surface some 300 ft. riverward from the construction shafts and between the tubes. From this shaft, twelve 8-in. dia. screen pipes were forced out into the sand just above the clay to such lengths as would drain an elliptical pattern with its long axis along and under the tunnel line. By pumping some 2,500 to 3,000 gpm. it was possible to keep the water to near the shaft bottom elevation of 57 ft. below sea level between the dewatering shaft and the construction shaft. On the riverward side, groundwater gradient rose gradually. Full details of this installation are given in an article titled "Ground Dewatering for Construction", *ENR* April 20, 1944, vol. p. 556.

Dewatering the ground enabled the contractor to set the shield and start tunneling operations in free air thus eliminating slow and costly work that

HEADING GANG, (26 psi. air) GEO. H. FLINN CORP. CONTRACT, MIXED GROUND

Work 6 hrs. per shift—3 hr. on, 3 hr. off, 3 hr. on.

	8 AM–5 PM	11 AM–8 PM	8 PM–5 AM	11 PM–8 AM	Rate per hr.	Pay per day
Foreman, heading	1	1	1	1	2.66⅔	16.00
Foreman, iron	1	1	1	1	2.58⅓	15.50
Erector operator	1	1	1	1	2.50	15.00
Iron handlers	8	8	8	8	2.33⅓	19.00
Miners	5	5	5	5	2.50	15.00
Muckers	9	8	7	8	2.33⅓	14.00
Mucking machine operator	1	1	1	1	3.00	18.00
Lock tenders	2	2	2	2	2.50	15.00
Lock tenders helpers	1	1	1	1	2.33⅓	14.00
Electrician	3	1	1	1	2.50	15.00
Hydraulic men	6	1	1	1	2.50	15.00
Motorman	1	1	1	1	2.50	15.00
Brakeman	1	1	1	1	2.33⅓	14.00
Helpers, general	5	5	5	4	2.33⅓	14.00
Grout Crew, 26 psi. air						
Foreman, grout	1	1	1	1	2.58⅓	15.50
Monorail operator	1	1	1	1	2.50	15.00
Pan men	2	2	2	2	2.50	15.00
Pan helpers	4	4	4	4	2.33⅓	14.00
Between-locks crew, 18 psi. air						
Foreman	1	1	1	1	2.41⅔	14.50
Lock tenders	3	3	3	3	2.33⅓	14.00
Lock tenders helpers	2	2	2	2		
Motorman	1	1	1	1		
Brakeman	1	1	1	1		
Outside tunnel crew, free air						
Gage tender		1	1		2.00	12.00
Lock tender	1	1	1	1	2.16⅔	13.00
Lock tender helper	1	1	1		2.00	12.00
Hydraulic man			1	1	2.50	15.00

Surface gang, general and supervisory	8 AM–4 PM	4 PM–12 night	12–8 AM
All	134	55	49

otherwise would have been necessary through air decks in the construction shafts.

Elimination of need for air pressure at the start avoided the danger of a "blow out" at the top of the shield due to unbalanced head in the shallow cover over the tunnel near the construction shafts.

The two tubes of the tunnel were driven 425 ft. in free air and had some 30 ft. of cover over the top of the shield when it was necessary to use air under pressure in the tunnel to prevent water from flowing in through the forward end in such quantities as to make excavation hazardous and difficult. Pumping of the radial well was continued for as long as the tunnel top was in the sand strata and had a very beneficial effect even after the shields advanced to under open water.

Excavation for sections constructed in free air and under presure was done by similar and somewhat conventional method. Working through small pockets in the shield, soft ground was mucked by hand and moved back to where it could be allowed to fall to the bottom of the tunnel. The face was breasted with horizontal lagging strips as excavation was carried on. Working down from the crown the lagging followed the excavation closely and was held by jacks operated from the shield.

Air pressure, when used, was balanced against water pressure at about the spring line of the tunnel. Due to the shallow cover, extreme care was taken to prevent blowouts by packing tightly around the upper part of the heading with marsh hay and bagging. Some cement grouting was done ahead of the excavation.

The shield was shoved ahead 32 in. at a time to accommodate a ring of lining. Generally, about half of the 28 hydraulic jacks, of 10-in. dia. operating under 5,000 to 6,000 psi. pressure, were used to make the shove. The rest of the jacks were used as occasion demanded to give an extra force on one side to change slightly the direction of the shield.

A 32-in. ring of cast iron in 14 segments and a key was set by a hydraulic powered erector arm on the rear of the shield. Bolts in the heavy lining were 1¾ in. dia. and were drawn up to 30,000 psi. by manually handled wrenches.

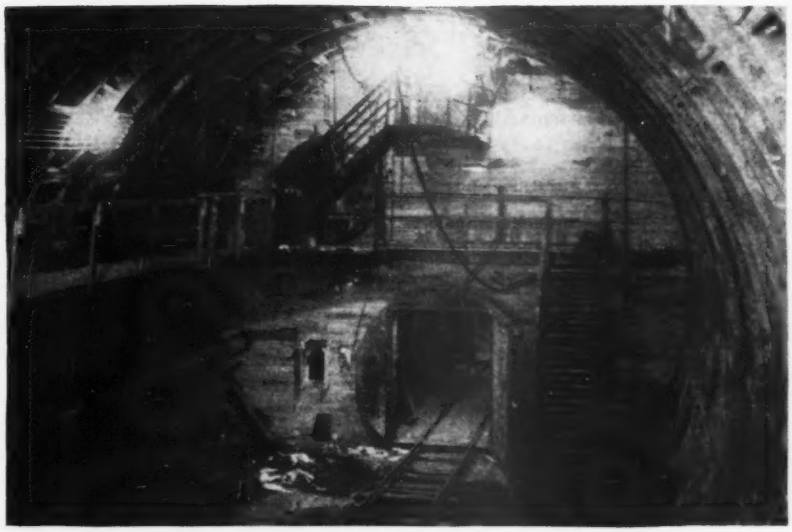

Fig. 11. Compressed air lock (not in service) on Brooklyn end of the construction. Material lock at bottom; man lock at left center and emergency lock at top.

To avoid settlement by subsidence into the annular space left by the tail of the shield as it moved forward, gravel packing was started immediately by blowing pea gravel through the grout holes in the lining as soon as the shield advanced.

Under some conditions the shield was shoved only half of the 32 in. length of a ring and gravel packing was done before completing the shove.

Grouting with a wet sand-cement mix forced into the gravel was done as soon as practical to prevent loss of ground and subsequent settlement of the surface above.

The shields were driven near several heavy buildings. Unimportant structures were demolished. None of the buildings left standing, including a nine-story brewery, a six-story winery, and other old brick structures showed any appreciable settlement or cracking, despite the 31-ft. 8-in. dia. shields moving only a few feet from their supports.

As the shields reached the river, some loss of air occurred due to shallow cover below dredged slips and in the channel. A temporary blanket of clay, up to 20 ft. thick, dumped over the tunnel line assisted in reducing air loss and preventing a possible blowout. This was removed as soon as the shields passed to restore navigable depths of 41 ft. in the slips and 35 ft. in Buttermilk Channel.

Air pressure throughout the work was about 6 psi. less than the theoretical. In sand at the shore, pressure reduction was made possible by the radial well dewatering; under the river a layer of good clay helped to hold out the water. Maximum pressure reached was 37 psi.; at this pressure the sandhogs worked 1½ hr., were off for 4½ hr. and then returned for an additional 1½ hr. Thus eight shifts were required for 24 hr. per day work.

When air was above 25 psi. pressure, two locks were in use in each tube with a pressure differential between them. Workmen could quickly decompress from 26 psi., for example, to 18 psi. then walk some 800 ft. to the second lock where decompressing was completed. This arrangement has been found to aid decompression and to be more acceptable to the workmen.

No unusual difficulty was experienced in driving the shields, due undoubtedly to constant care and vigilance. The shields have both entered full rock face and have been left at that point temporarily.

For the 1,000 ft. of rock tunnel in the contract the procedure planned is to drive a bottom drift about 20 x 20 ft. in a manner similar to that described for the Manhattan end of the tunnel. Instead of holing-through immediately, it is planned to leave a "plug" of 25-ft. of rock temporarily to protect the Brooklyn section from any mishap causing flooding that might occur.

Slide Rule Speeds Pipe Studies For Water Supply Systems

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***Editor's Note**—Another method for solution of pipe network problems is presented here. Using a slide rule, friction loss tables, and a skeletonized outline of the water distribution system computations may be made quickly and directly on the map—the degree of refinement being dependent upon the designer's standards. The author reports favorable acceptance wherever this procedure has been introduced.*

HYDRAULIC ANALYSES of pipe networks demand several applications of trial-and-error procedure. Using a slide rule with A-, C-, and D-scales, a table of friction losses in pipes, and a skeletonized map of the system, computations can be made quickly and accurately. Problems worked directly on the map may be figured roughly or carried to any desired refinement.

The slide rule method is based on the fact that $Q = K\sqrt{h}$ over a fairly wide range of flows. Q represents the flow in gpm., h is the loss of head in ft., and K is the pipe contant. In this method the Hazen and Williams formula is used with the coefficient C equal to 100.

To demonstrate the range over which the expression holds, consider the loss of head in 1,000 ft. of 6-in. pipe.

From the Hazen and Williams table this loss amounts to 33.0 ft. under a flow of 500 gpm. Then,

$500 = K\sqrt{33.0}$ and $K = 87$

The following table reveals the extent of error in the basic formula over a wide range of flows.

Percent of error in the basic formula

Flow (gpm.)	Head loss H & W (ft.)	Head loss $Q = 87\sqrt{h}$ (ft.)	Percent error from H & W
100	1.4	1.32	− 5.7
200	6.2	5.3	−14.5
300	12.9	11.9	− 7.8
400	22.1	21.3	− 4.1
500	33.0	33.0	0
600	47.0	47.5	+ 1.1
700	62.0	65.0	+ 4.8
800	80.0	84.2	+ 5.3
900	101.1	106.0	+ 4.8
1000	120.4	132	+ 9.6

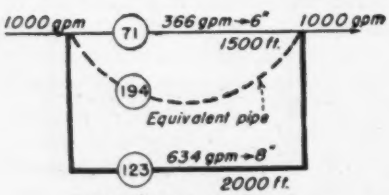

Fig. 1. In a simple application of the method flows are found to be 366 and 634 gpm. in the 6 and 8-in. pipes respectively. The values of pipe "constant", K, are given in circles.

In the first problem a flow of 1,000 gpm. is distributed between two lines as shown in Fig. 1. To solve for K in each pipe flow of 500 gpm. in each will be assumed. From Hazen and Williams tables head (h) for the 6-in. line is 49.5 ft. Then, $500 = K\sqrt{49.5}$ and $K = 71$. Similarly for the 8-in. line, $500 = K\sqrt{16.4}$ and $K = 123$. Since head loss in the pipes must be equal, flow is directly proportional to the pipe constants. Flows in the 6-in. and 8-in. pipes are found to be 366 and 634 gpm. respectively.

This computation will be recognized as a variation of the "equivalent pipe" method. The constant, K, for an equivalent pipe is the sum of the K 's of lines making up the imaginary pipe.

Rule—The constant, K is found on the slide rule by placing h, on the A-scale opposite Q on the C-scale. Then, K is read on the C-scale at the end of the rule.

Rule—To find h when K is known, set K on C-scale opposite Q on D-scale and read h on A-scale at the end of slide.

Second problem solved

Analysis of a more intricate system such as that shown in Fig. 2(a) further demonstrates application of the method. The pipe constants (circled) have been computed using 500 gpm. for 8-in. pipes, and 250 gpm. for 6-in. mains.

Judgment of the designer is an asset as a good initial "guestimate" saves much time and computation. The first trial is made by assuming flows in pipes as shown in Fig. 2(b).

Starting at point A, flow is apportioned equally to each branch. With slide rule 500 (D-scale) is divided by 175 (C-scale) giving a head loss of 8.2 ft. (A-scale). Similarly, head loss (f) in line A-C is found to be 73.0 ft. Since the loss is greater at point C than at point B, flow probably will be from B to C. The friction in line B-C found to be 5.9 ft. is added to 8.2 ft. giving a total loss of 14.1 ft. at point C.

However, two unequal values now exist at point C where equality should exist. The correct loss is determined by the following method: A pipe network is in reality a compound pipe in which the total flow, Q, equals $K\sqrt{h}$. In a balanced system flow at any point also will be given by Q

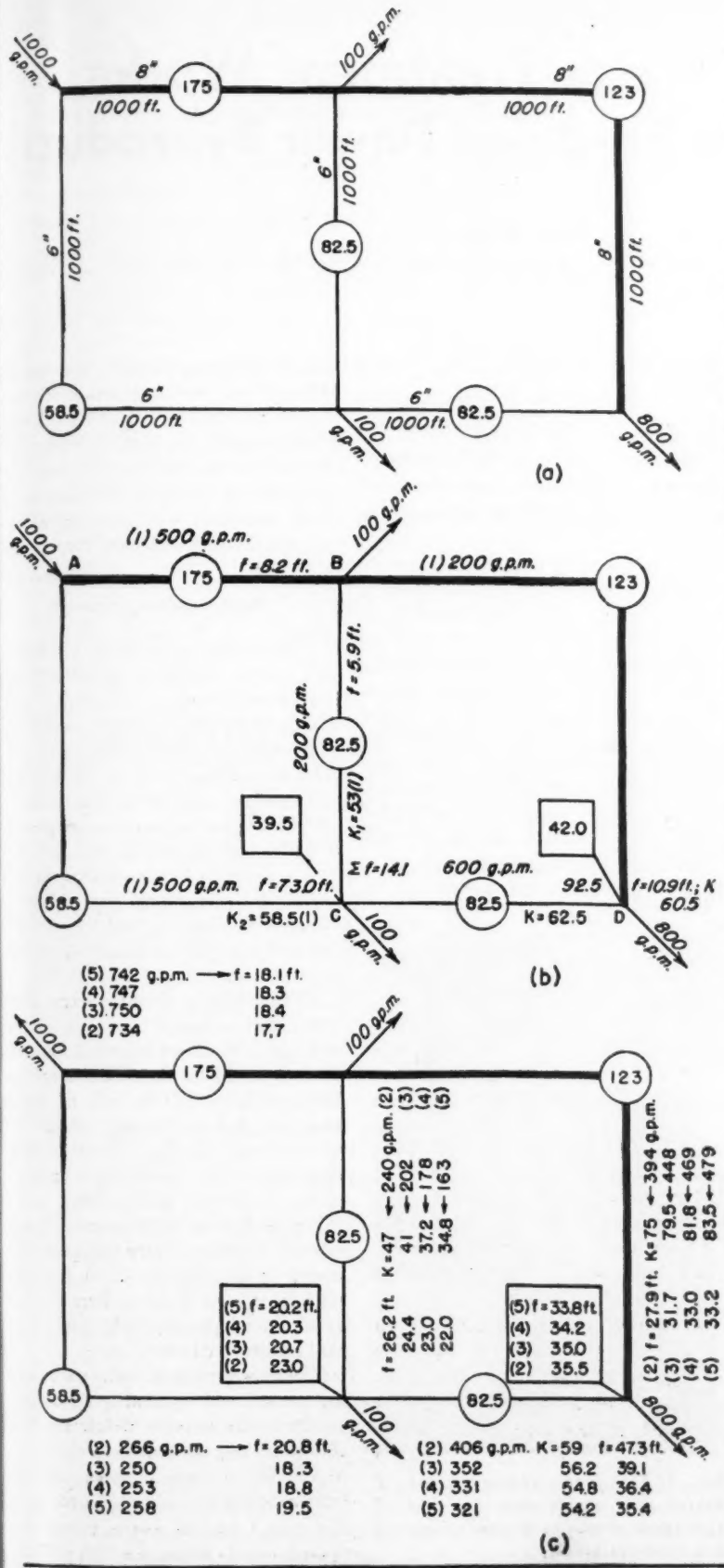

Fig. 2. The slide rule may be used to solve a problem of one inlet and three outlets as laid out in (a). The first step using a good "guestimate" for divided flows is outlined and analyzed in (b). Finally, application of the method to the fifth refinement is shown in (c). Pipe "constants", K, are given in circles and equated heads in squares. Friction losses are indicated as f.

$= K\sqrt{h}$. Thus, at point C, $K_1 = 53$ and $K_2 = 58.5$. Then,

$$Q_1 = K_1\sqrt{h} \quad \text{and} \quad Q_2 = K_2\sqrt{h}$$

and

$$Q_1 + Q_2 = (K_1 + K_2)\sqrt{h}$$

$$\frac{Q_1 + Q_2}{K_1 + K_2} = \sqrt{h}$$

Rule—Divide total Q on D-scale by total K on C-scale, and read equated head, 39.5 ft., at end of slide on A-scale.

Similarly, head loss in line C-D is found to be 53.0 ft. which, added to 39.5 ft. of line A-C, gives a total of 92.5 ft. at point D. Also, the friction loss in line B-D is calculated at 10.9 ft. Then, pipe constants, K, are computed on each side of point D, and the equated head, 42 ft., is determined by a similar calculation.

Finally, flow is prorated backwards—directly in proportion to the K constants at point C and D. Head losses and K values are computed again using the new values. Re-distributions [Fig. 2(c)] are made until the desired accuraey is obtained. For absolute accuracy the pipe constant, K, must be recalculated for each pipe.

Computations in Fig. 2(c) are carried out to the fifth stage where all values are accurate to six percent excepting that for line B-C which is correct to thirteen percent. However, the total head-loss accuracy is within two percent—in fact, it is within seven percent on the second distribution.

When domestic flow is known, recomputation with fire demands is not necessary. The head loss due to fire flow at any point is calculated. Then, the combined loss is found from the following equation:

$$h\ (\text{combined}) = [\sqrt{h}\ (\text{domestic}) + \sqrt{h}\ (\text{fire})]^2$$

The method described above was developed by the author during the war as a means of checking rapidly pipe network designs at military installations.

Distillery Waste Treatment Works Provides Cattle Feed and Power Byproducts

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***Contents in Brief**—Disposal of large quantities of distillery slops called for special measures to minimize stream-pollution hazards. At first the wastes were lagooned in ponds but this was unsatisfactory. Eventually a process was developed for the treatment of slops to recover grains suitable for cattle feed. In addition to this byproduct recovery, surplus steam from the plant also is used to generate electricity, reducing the power bill $1,800 monthly.*

OPERATION of distilleries at peak capacity for the production of alcohol during the war period created a serious stream-pollution hazard that stimulated research on methods of waste disposals. The problem of "slop" disposal and the manner in which a by-product recovery treatment process was evolved for The Old Clover Distillery Co. in Pennsylvania is an example of development in the practice of industrial waste handling.

The distillery, which is located near Tunkhannock, Pa., on a small stream 7½ mi. from the north branch of the Susquehanna River, first attempted to salvage most of its raw wastes by mixing them with grains to produce a cattle feed. Unless the proportions were carefully regulated, however, the food would make the cattle sick. Because of the delicate control required, this method was abandoned.

Temporary disposal was difficult

Restrictions of the War Production Board precluded the opportunity of building suitable disposal facilities and the company turned to temporary measures. The method selected involved excavation of large pits into which about 60,000 gal. of slop per day were wasted. These pits were located in sand and gravel subsoil that permitted infiltration but not direct seepage to the stream; consideration was also given to the prevention of surface flow during rainy weather.

To meet the requirements for suitable pits was difficult, as hilly terrain and underlying rock predominated in the vicinity. Sites were found, however, within a radius of several miles where satisfactory pits were dug and utilized. Nevertheless, despite almost continuous operation of a power shovel, scarcely enough pit-capacity was provided to dispose of the slop produced up to the time the distillery was closed for postwar reconversion.

Shortage of cattle feed during the war's final months prompted the War Food Administration to sponsor a broad program through the Defense Plant Corp. for construction of plants to produce feed from distillery wastes. As allotments of grain for manufacture of distilled spirits were made dependent on facilities for recovery of feed, attention was focussed on design and construction of recovery installations.

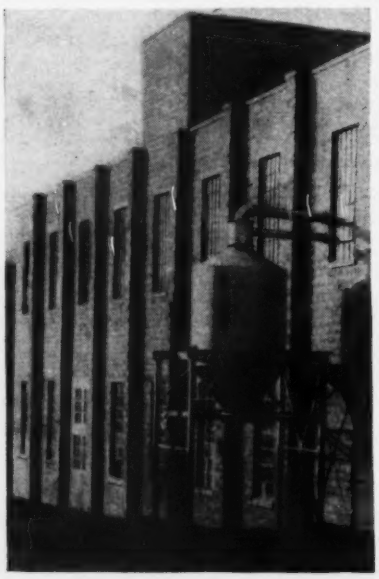

Fig. 1. The feed recovery plant is housed in a simple structure built of structural steel, reinforced concrete and concrete block.

Feed recovery process

The method adopted for producing dry grains consists of passing distillery slop through a perforated screen, compressing the material retained on a screen, and evaporating the liquid. The evaporated syrup is then mixed with pressed cake and with dry grain recycled from the end of the process. Finally, this mixture is dried in rotary steam-tube ovens. The end product is blown into a cyclone unit from which it is passed to bulk storage, the bagging machine, or back to the mixer as required.

Design of the feed-recovery plant was based on use of about 85 percent rye with a distillery capacity of 1,800 bushels per 22 hr. day. Such consumption produces 72,000 gal. of whole slop per day containing about five percent total solids. Further, thin slop going to evaporators contains about 2.7 percent total solids. There it is concentrated to 30 percent. Solids content of the press cake also is estimated at 30 percent. The recovery plant is designed to produce sixteen tons of feed per day with an 8 percent moisture content.

The recovery plant utilizes a vibrating screen and continuous, rotating-eccentric-disc presses which produce 50,000 lb. of cake per day containing 35,000 lb. of water. Three vertical-tube evaporators with separate heat and vapor bodies, entrainment separators, and automatic liquid-level

controls are connected in series.

Thin slop is introduced into the second unit. Then the concentrate from this unit passes into the third, and finally back to the first evaporator where it is recirculated by a motor-driven pump to accomplish desired concentration.

Steam passes through evaporators in the normal order and then to a barometric condenser cooled by water from a nearby pond. All condensate is discharged into a small creek with provisions for emergency storage during periods of extreme drought. Furthermore, a high-rate, recirculating, rock filter for treatment of this discharge is planned. This measure will insure that polluted matter will not be discharged into the receiving stream.

Evaporators are rated at 22,750 lb. of water per hr. utilizing about 0.40 lb. of steam per lb. of water evaporated. The condenser consumes 545 gpm. of water or 33.4 lb. per lb. of steam condensed. Each rotary dryer is designed to evaporate 3,050 lb. of water per hr. with 6,800 lb. of steam.

Because the waste, syrup, wet grain and the resulting vapors are highly corrosive, acid-resistant metals—such as copper alloys and cast iron were required for parts of equipment coming into contact with such products.

Electricity is produced

Harnessed to the recovery plant is a 600 hp. boiler, which in combination with that of the distillery, produces steam economically at higher pressure than required for the various machines. By directing this surplus energy to an extraction turbine motivating a direct-current generator, 400 kw. of electricity is obtained. Of this amount half is used in the distillery, and half in the feed-recovery plant. An estimated power saving amounting to $1,800 per month accrues from this installation.

As the Old Clover Distilling Co. is located in an area of extensive dairy farming, dry grains produced by this process should find a ready market among local dealers who, by mixing with other ingredients, can produce a feed suitable for that region.

Armand Hammer and M. Stone are president and manager, respectively, of the Old Clover Distilling Co. and E. Brensiber is technical supervisor of the recovery plant. Ray T. Hoffman prepared the construction plans and specifications under the general direction of the author.

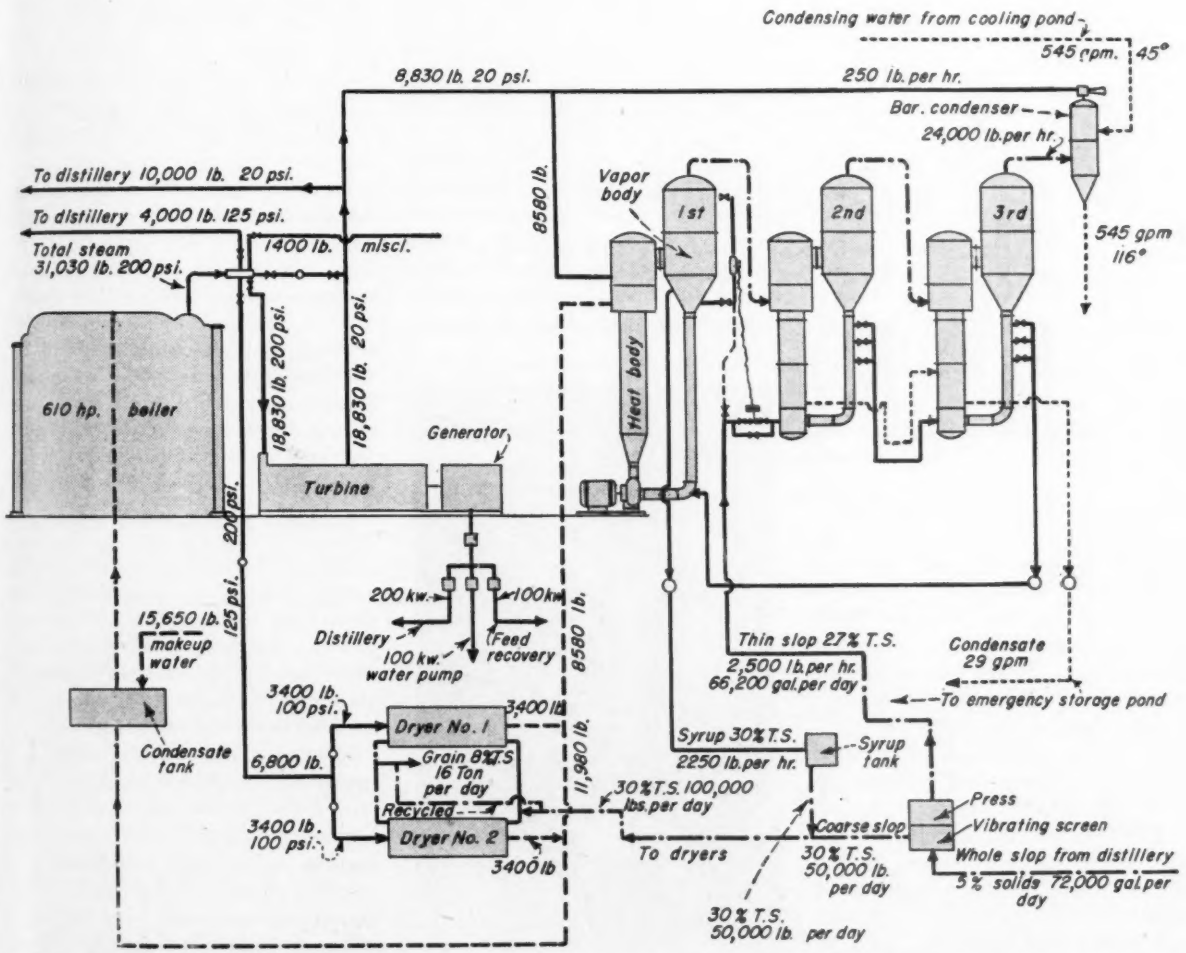

Fig. 2. Processing units and flow diagram of the recovery plant that produces cattle food from distillery slop. Whole slop from distillery enters at lower right. After passing screen and presses, thin slop enters evaporators (upper right) where syrup is produced. Taken from the storage tank, syrup is mixed with the coarse slop leaving press. This mixture is dehydrated in dryers (lower left) producing grain. The steam hook-up is shown at the upper left

How Fire-Safe is a Fireproof Building

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***Contents in Brief**—Four basic requirements determine the relative fire-safety of buildings for human occupants. Design data and tested products are available to meet these essential needs in both old and new structures at costs which are low in comparison with the toll exacted by loss-of-life fires. Application of established principles and proved devices can add a high degree of fire-safety to so-called fireproof buildings.*

THERE is no building that is fireproof. A truly fireproof building can exist only in the minds, or on the drafting boards, of fire protection engineers. Disastrous fires within six months of each other in the "fireproof" La Salle and Winecoff hotels have given us ample evidence of that fact.

Just what does constitute a fireproof building? Insurance underwriters will tell you that a fireproof building is one constructed of masonry walls and incombustible floors and roof. This type of structure is expected to withstand a fire that consumes its contents and yet leaves the structural portion of the building relatively undamaged. According to this definition, both the La Salle and Winecoff hotels were fireproof buildings. The contents were consumed and the structures remained intact.

In the minds of the public, the definition of a fireproof building would be quite different. It might read: "A fireproof building is a structure so designed that, in event of fire in any room, the fire and smoke would be confined to that room until extinguished." To venture an estimate, not one percent of our so-called fireproof buildings will measure up to the public's definition.

With that situation facing us, we can expect similar disasters in the future. Throughout the country are department stores, office buildings and institutional structures, such as schools and old peoples' homes in which the stage has been set to duplicate these tragedies. All the props are there: excessive amounts of combustible materials, unprotected vertical openings, inadequate exit facilities, and lack of automatic detection and extinguishing devices. All that is needed is the source of ignition, and it is ever present in the hands of millions of occupants.

Most of these existing buildings are super-efficient incinerators, capable of consuming quickly anything combustible, either human or inanimate, placed inside them. A furnace expert could not have improved the typical design—a tall incombustible flue, open at the top and bottom, with provision for a direct draft up through the center.

A fire door properly installed at the foot of this open stairway in Winecoff Hotel, Atlanta, would have prevented spread of fire to upper floors.

This is the condition in countless hotels, office buildings, hospitals, schools and other public buildings. Unless we take immediate steps to remedy the situation, we can expect reprisals in the form of restrictive legislation. After Chicago's La Salle fire, the investigating committee broadcast the familiar warning: Eliminate open stairways and open elevator shafts to prevent the spread of fire from floor to floor. The hotel holocausts, following quickly one upon another, have touched off a barrage of ordinances, restrictions and regulations, some ill-conceived, which threaten to put architects and engineers into a strait-jacket.

Our problem resolves itself into two main divisions. First, we are faced with thousands of occupied structures which must be protected and made to conform with what the public expects. Second, we have a simpler problem in those buildings still on the drawing boards. Let us consider first the more difficult problem of protecting the existing buildings. There are four fundamental remedies to be undertaken.

Reduction of combustible material

Elimination of fuel for the potential fire is basic. Modern science has given us a running start on this objective. Draperies, upholstery and other fabrics are now available in glass and synthetic materials which are practically incombustible.

Likewise, tested surface coating materials are available that have been proved to render wood and other interior combustible surfaces slow-burning and almost completely incapable of spreading fire. These fire-resistant materials, plus the elimination of combustible furniture wherever possible, will reduce the severity of any fire that may occur, and, even more important, reduce the possibility of ignition.

Restricting or confining the fire to its point of origin is the most difficult problem in an old building. The most deadly feature is the open stairway or elevator shaft. In almost every fire in which there has been heavy loss of life, the most important single factor has been unprotected vertical openings.

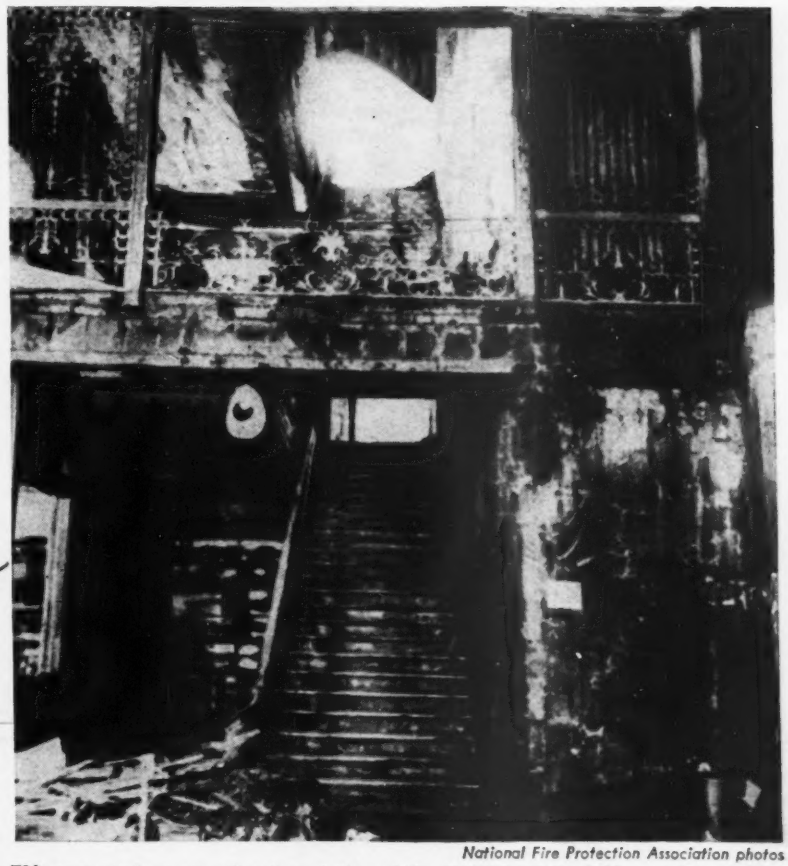
Two significant examples are the hotel fires already mentioned. In both buildings, stairway inclosures would have confined the fire to the floor on which it originated. With such inclosures, one or two lives might have been lost in either fire, but catastrophes could not have developed.

In the La Salle Hotel building, the original plans had called for corridor doors, which would have confined the fire and smoke to the section containing the stairways and elevator shaft. Someone made the decision to omit the doors, and 40 years later 61 persons paid with their lives for that decision. After the Winecoff Hotel disaster in Atlanta, James K. McElroy, National Fire Protection Association engineer, made the following statement in his report: "In this fire, a single $50 door installation at the entrance to the stairway from the third floor would have prevented the spread of fire to the upper floors."

Correcting hazardous conditions in old buildings, particularly with respect to open stairways and elevator shafts, is not simple, but neither is it too difficult. In most of the existing buildings, total inclosure of stairways is impracticable. However, the purpose of such inclosure is only to stop the strong updraft of heat and smoke and to hold back the flames long enough to enable firemen to enter and control the fire.

This purpose can be accomplished readily by constructing a partition and door at the head or at the foot or, preferably, at both ends of each stairway. A partition with a 2-hr. rating would be desirable, but a hollow partition with 1-hr. resistance can do an effective job. The 1944 edition of the Recommended Building Code of the National Board of Fire Underwriters, 85 John St., New York, gives construction details of types of partitions having various fire ratings, as summarized in Table I.

A 1-hr. partition can be easily



National Fire Protection Association photos

This open stairway leading from lobby of the Hotel La Salle, Chicago, is a glaring example of unprotected opening that permits rapid spread of fire and hot gases to upper floors.

TABLE I—FIRE RESISTANCE RATINGS OF NON-BEARING METAL FRAME PLASTER AND METAL STUD HOLLOW PARTITIONS

From 1944 Edition of the Building Code, National Board of Fire Underwriters. Ratings Based on Standard Fire Tests

Metal Frame Plaster Partitions, Solid

Details of construction	Minimum total thickness, inches, for rating of 2 hr.	1 hr.
¾-in. plaster of 86 parts gypsum, 12 parts sawdust and 2 parts asbestos fiber each side ¾-in. asbestos lath (medium), with sheet-steel H supports	—	2¼
1:2, 1:3 gypsum and sand plaster on expanded metal or perforated paper-backed welded fabric plaster base, on steel channel studs	—	2½
1:2, 1:2 gypsum and sand plaster on expanded metal lath, on steel channel studs	—	2¼
Unsanded, wood-fibered gypsum plaster on expanded metal lath, on steel channel studs	2¼	—
Gunite, 4½:1:7 portland cement, sawdust and sand mortar sprayed on welded wire fabric, on steel channel studs	—	2½
¾-in. 1:1 gypsum and sand plaster each side of ¾-in. gypsum plaster board; steel stud supports	—	2⅛

Metal Stud Hollow Partitions

Details of construction	Rating, hours
¾-in. unsanded, wood-fibered gypsum plaster on expended metal lath, each side steel studs	1
¾-in. 1:2 portland cement and sand plaster in the scratch coat, 1:3 gypsum and sand plaster in the brown coat, on expanded metal lath, each side steel studs	1
¾-in. 1:2, 1:2 gypsum and sand plaster on expanded metal lath, each side steel studs	1
1-in. unsanded, wood-fibered gypsum plaster on expanded metal lath, each side steel studs	2
½-in. 1:1 gypsum and sand plaster on ⅜-in. gypsum plaster boards each side steel studs providing 1¼-in. central air space	1
½-in. cement-asbestos board on each side 3-in. steel studs; interior space filled with mineral wool under air pressure	1

erected using metal studs with metal lath and ¾-in. gypsum plaster, with not more than two parts sand to one part gypsum. Such a partition erected around the stairway in a fire-resistant building will perform the functions required and eliminate the possibility of a quick-spreading fire.

Of special significance in such a partition is the door itself; it is the weakest link in the protective chain. The door must be constructed in accordance with the standards for Class B doors (Table II) as described in NBFU pamphlet No. 80, Regulations of the National Board of Fire Underwriters for the Protection of Openings in Walls and Partitions Against Fire. It must be equipped with a self-closing device and with a positive latch to hold it closed, regardless of draft conditions which may be encountered. It is on this point that most stairway inclosures fail. The doors require careful periodic maintenance, and they must never be blocked in the open position. Each door should be boldly lettered with a sign, such as, "This is a fire door. Never leave it open."

Elevator shafts can be given equivalent protection by inclosure with the same type of partitions. The important point to be emphasized is that all vertical openings must be protected.

Adequate exit facilities

In most large-loss-of-life fires, poor exit facilities have been a contributing factor. The Building Exits Code, published by the National Fire Protection Association, 60 Batterymarch St., Boston, contains detailed descriptions of the minimum requirements, giving all needed information. To summarize these requirements in brief: (1) The design should provide each occupant with at least two directions of exit; (2) inclosed exit stairways should discharge to the outside, not into a second floor corridor or lobby.

This second requirement is a difficult problem in hotel alterations. Hotel managements do not like inclosed stairways leading directly to the outside because of the obvious temptation to dishonesty that these exits offer. This objection is understandable; however, it would not take much ingenuity to arrange an alarm system within the stair shaft to announce the presence of persons within the emergency exit. Wired glass in metal frames also can be utilized in solving this problem, although the radiant heat transmitted reduces its effectiveness.

Another objection by hotel managements is the loss of valuable outside ground-floor space that results from constructing a stairway to the outside. This space is an important consideration in hotel financing, but it can easily be shown that the income sacrificed would be far overbalanced by the financial stress and loss of good will resulting from a loss-of-life fire.

Outside fire escapes at best offer an unsatisfactory substitute for a completely inclosed stair tower. Persons on the outside fire escape are subject to flames leaping from windows that they must pass.

One basic fact must be emphasized with respect to fire escapes. *Unless all interior vertical openings are protected it is useless to talk of escape facilities.* Under fire conditions, it probably would be impossible for human beings to live in the corridors long enough to reach the escape devices provided.

Detection and extinguishing devices

Development of automatic detection and extinguishing devices has come a long way toward helping engineers and architects to make buildings reasonably safe. Fully developed systems are available that will announce the rapid rate of rise of temperature and indicate at a central station the location of an incipient fire within a few seconds after it starts. These automatic guardians eliminate the delays caused by human hesitation to

TABLE II—SIZE LIMITATIONS FOR VARIOUS TYPES OF DOORS

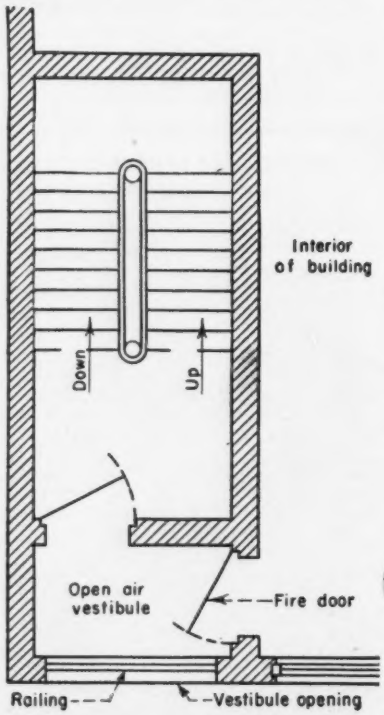
From 1944 Edition of the Building Code, National Board of Fire Underwriters.

The following types of doors when of standard construction are considered suitable for openings in vertical shafts (Class B situations) with size limitations at present in effect as given in the table.

Type of Door	Maximum size of openings not to exceed: Area, sq. ft.	Height, ft.	Width, ft.
*Hollow metal, sliding	—	8	8
Hollow metal, swinging, in pairs	—	10	8
Hollow metal, swinging, single	—	10	4
Metal clad, paneled, swinging, in pairs	—	8	8
Metal clad, paneled, swinging, single	—	8	4
Sheet metal, sliding, single	120	12	12
Sheet metal, sliding, in pairs	120	12	12
Sheet metal, swinging, in pairs	—	12	10
Sheet metal, swinging, single	—	12	6
Steel, counterbalanced	—	10	8
Steel, rolling and lift-up type	120	12	12
Tin-clad, two-ply, counterbalanced	—	10	8
Tin-clad, two-ply, sliding, single	80	10	10
Tin-clad, two-ply, swinging, in pairs	80	10	10
Tin-clad, two-ply, swinging, single	—	10	6

* When specially designed and labeled for use in Class B openings.

Note:— Fire doors containing wood, cork or similar materials may emit considerable smoke when heated; this should be considered when selected doors for hospitals, stair-towers, etc.



For smoke-free means of egress, this common type of fire tower is recommended as one of the best, providing complete inclosure with access at each floor through a vestibule that is open to outside air.

call the fire department. The fire equipment is on its way without waiting for a human decision.

In addition to these and other devices that have been in use for many years, we are on the verge of making practical application of entirely new principles of fire detection, the use of ultra-violet or infra-red radiation to actuate a radiation counter set to transmit an alarm above a predetermined radiation density. This type of device will be practically instantaneous. It represents a great step forward in the fight against fire.

Of all the equipment devised by man to protect himself against fire, none has equaled the record compiled in the case of automatic sprinklers. They provide a constant control factor ready to leap into action at any hour of the day or night. In existing buildings they can be utilized to protect stairways, corridors and areas containing combustible material. Used in this way, they greatly reduce the possibility of loss of life.

Fire protection for new buildings

With a large store of accumulated experience at their disposal, one would be justified in assuming that architects and engineers had learned their lesson and would incorporate in their new designs at least the four basic requirements already outlined. On the contrary, study of many plans for new construction in the last two years reveals that designers still are doing a great deal of wishful thinking in their planning for fire resistive buildings. Combustible interior trim is still freely used, and, although the tightening of city ordinances has reduced the number of open stairways, we are a long way from complete floor opening protection.

What is responsible for this apparent disregard of the public's interest on the part of architects and engineers? First, the designers are under pressure to hold costs down to a minimum, and they naturally are looking for items that can be sacrificed without reducing the utility value of the structure. At first glance omission of many of the fire protection and safety features looks like a legitimate source of economy, despite the evidence of experience that these savings often prove to be the most expensive possible.

Lack of training is the second potent reason for the apparent disregard by architects and engineers of fire protection and safety requirements in designing new buildings. Few architectural schools touch upon the subject of fire protection and safety in spite of the fact that the architect is constantly confronted with standards and building codes that assume at least a basic knowledge of fire-protection principles. Illinois Institute of Technology is the only school in the country with a 4-year curriculum in fire protection engineering, providing opportunity for training in these subjects for all its engineers and architects. Some day fundamentals of fire protection will be a required subject for every architect. Only then shall we be able to look forward confidently to fireproof buildings entitled to that name.

Repayment Plans for Central Valley

Announcement was recently made in Sacramento by Richard L. Boke, regional director, U. S. Bureau of Reclamation, of the submission to Congress of a plan for allocation and repayment of costs of the initial features of the Central Valley project. This plan has been approved by the Secretary of Interior and by President Truman. Of the $384,314,000 cost of the initial features of the project, $334,787,000 will be repaid to the government and the remainder, $49,527,000, is chargeable to flood control and navigation and is not to be repaid.

Repayment computations are based on completion of water supply features in 1950 and full utilization of irrigation facilities by 1965.

That part of the cost of the project attributable to various project features and the amount to be repaid by each is as follows:

	A	B
Navigation	$18,083,000	.....
Flood Control	31,444,000	.....
Irrigation	221,551,600	$58,545,475
Municipal and industrial water	99,091,800	29,667,932
Power	104,143,600	227,757,693
TOTAL	$384,314,000	$315,971,100

Column A—Net cost attributable to each feature.

Column B—Estimated revenues for repayment.

The cost figure for irrigation includes $18,851,900 for construction of additional canal capacity to provide for future projects not included in the currently authorized program.

According to the plan, payments will be completed in the year 2009. If the future projects are not built, the amount for additional canal capacity will extend the time necessary to complete payments until the year 2012.

In computing cost allocations, the following were taken into account but no cost was allocated to them: National security, recreation, salinity control, and fish protection.

The navigation and flood-control allocations were submitted to the Secretary of War for his views. He disagreed with the capitalization of the flood-control benefits over 100 years rather than 50 years and suggested allocating $25,604,000 for flood-control benefits instead of the $31,444,000 used.

Cost allocations for the other items in Column A were obtained by averaging the proportionate actual cost of the work and the cost of attaining the same purpose by an alternative single purpose project.

The amount to be repaid by the various project features is based on the actual ability to pay. For irrigation this was computed without interest on a charge of $2.70 per acre-ft. for Class I water and $1.45 per acre-ft. for Class II water. Operating costs were deducted from revenues thus estimated and an allowance of $23,000,000 was made because water rates will be determined annually based on the water users' ability to pay and such rates may fall below those used as a computation base. Without this reduction the project could be paid off by the year 2004.

Class I water is "firm" water of an ascertainable amount with respect to which the government will undertake a definite obligation to deliver a specific amount annually. Class II water is water that is only intermittently available.

Power revenue was computed on the basis of 4.57 mills per kw.-hr. with an interest charge of 3 percent and the revenue from municipal and industrial water was computed on the basis of $10 per acre-ft. with a similar interest charge.

Fig. 1. A top chord of concrete and steel and split or V-diagonal characterize this welded truss bridge in Spain.

Steel and Concrete Combined In Spanish Truss Bridge

***Contents in Brief**—Trusses of 148 and 177-ft. span were built with a reinforced concrete top chord and structural steel bottom chord and diagonals for a bridge at Tordera, Spain. All steel fabrication was by arc welding. The spans were assembled on the bank and launched into place by cantilevering and the use of temporary extensions.*

AN UNUSUAL BRIDGE in which an attempt was made to utilize efficiently the differing characteristics of structural steel and reinforced concrete has recently been completed at Tordera, Spain, in the province of Barcelona. As described in the April issue of *L'Ossature Metallique*, publication of the Belgium-Luxembourg structural steel industry, the bridge consists of three truss spans (148 - 177 - 148 ft.) in which the top chords are of reinforced concrete while the bottom chords and diagonal web members are structural steel. Other notable features of the trusses are the adoption of a V-form for the diagonals and the use of electric arc welding for all fabrication. The spans were assembled on the river bank and launched across the abutments and piers by cantilevering, assisted by a temporary nose and tail.

As shown in the accompanying illustrations, the trusses are of fish-belly shape, the arc of the lower chord being that of an ellipse rather than a parabola so as to increase the slope at the supports and thus minimize secondary stresses as well as to permit a more uniform distribution of loads on the diagonals. Additional concern for the stresses at the joints of the diagonals and the concrete top chord led to the division of the diagonals into two parts, resulting in the V-form. This arrangement is said to assure better stability of the web system against buckling, eliminating secondary and lateral flexural stresses, and as a consequence permitting omis-

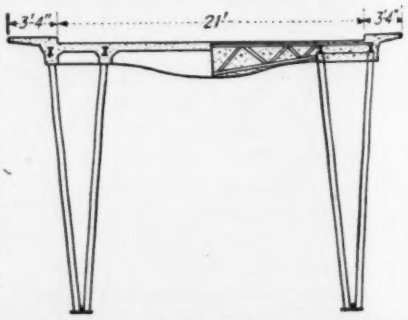


Fig. 2. Cross section of Tordera bridge indicates how steel and concrete were combined. Note absence of transverse bracing below deck.

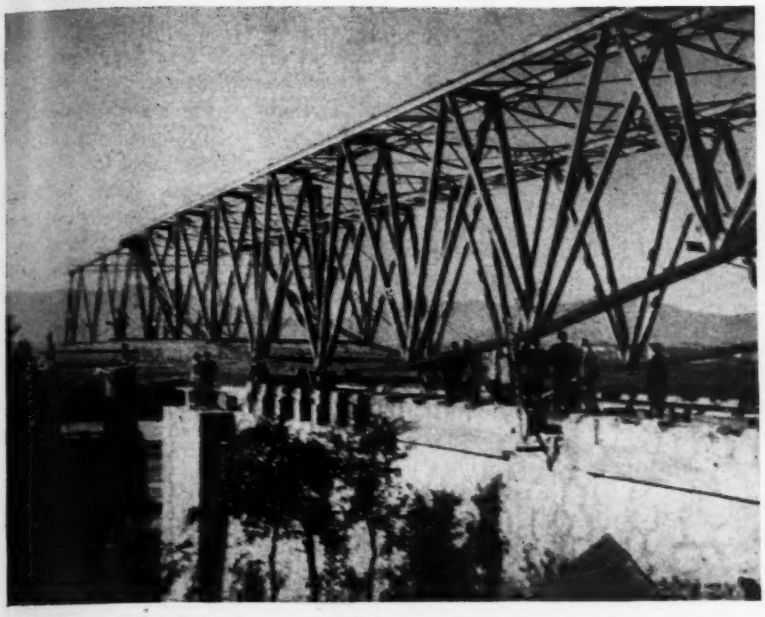


Fig. 3. Launching first span of bridge on tracks laid over the abutment. Note the top chord and floorbeam steel that serves as reinforcing for the concrete to be placed later.

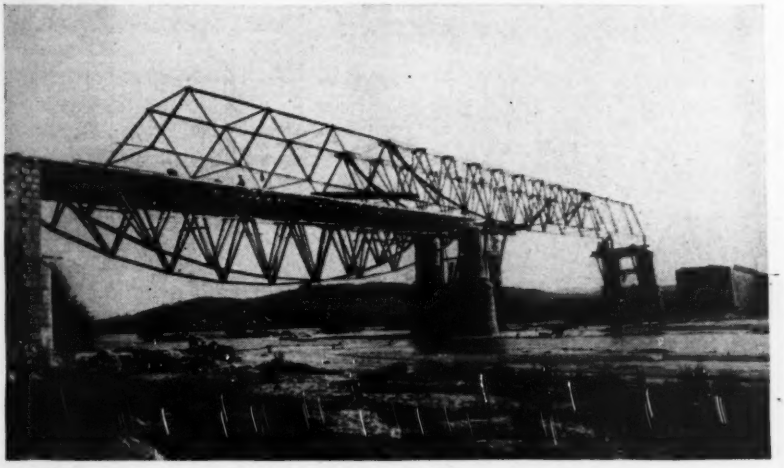


Fig. 4. Temporary nose and tail trussing was required in launching the spans and lowering them into position.

sion of all transverse wind bracing below the floor of the bridge. Although the polygonal trusses and V-diagonals complicated the assembly, it is claimed that, by the use of welding, all joints were made without difficulty and with great accuracy, in addition to causing the minimum of interference to placing the concrete and to the transmission of stresses into the concrete around the joints.

The diagonals have a closed box section fabricated from two welded U-shapes. The bottom chord is simply a flat plate to which a vertical stiffener plate is welded to prevent bending from joint to joint. Reinforcing for each top chord is a part of the structural steel system, and consists of two small I-sections connected by light lateral bracing. The floorbeam reinforcing is in the form of a light steel truss which serves as a strut between the two main trusses during erection.

After the spans were launched and lowered to their supports, the concrete in top chords, floorbeams and the deck was placed. Measurements of deformation of the completed bridge showed good agreement with calculated values. Under test live load, some negative deflections of the deck were observed, and were determined to be the result of temperature differences between the metal and concrete parts of the structure, a 15 deg. difference accounting for a deflection of about 0.4 in. It is conceded that such movements may cause cracks in the concrete that may or may not require maintenance to protect the steel from corrosion.

The Tordera Bridge, which provides a 21-ft. roadway and two 3 ft. 4 in. sidewalks, was constructed by the Société Omes, an affiliate of the S. A. Esab Iberica for the Spanish Administration of Bridges and Roads. The project is the work of E. Torroja, director of the state testing laboratory, and of J. Lagarde and A. Andreu, director and engineer of public works of the province of Barcelona.

Cities Set Employment Records

Cities, states and schools added nearly 400,000 more civil servants to their payrolls last year, marking their first personnel expansion since before Pearl Harbor and partially offsetting the federal employment shrinkage.

While federal personnel cutbacks have paralleled dismantling of federal wartime machinery, resumption and expansion of state and local services curtailed by the war, coupled with the current boom in education, has boosted employment in other levels of government to an all-time high.

Big reason for state personnel increases is the burgeoning state public works program, covering both deferred maintenance backlogs and planned construction. Another factor is the return of the United States Employment Service to the states last November. State employment increased from 479,000 to 569,000 last year while state payrolls mounted from $198 to $256 million.

At the municipal level, wartime growth of cities is a big factor in current personnel increases. Public works backlogs are another major cause. Municipal employment increased from 861,000 to 984,000 last year, while city payrolls mounted from a total of $129 to $156 million.

Davis Dam Structures Revised To Cope With Bad Rock Conditions

***Editor's Note**—The following statement on the reasons for design changes at Davis Dam was prepared by the Bureau of Reclamation at the request of Engineering News-Record. For a complete description of the dam see the issue of Aug. 22, 1946, vol. p. 230.*

TO OFFSET local foundation weakness, changes in the design of structures appurtenant to Davis Dam are now being made. Davis Dam is under construction by the Bureau of Reclamation on the Colorado River approximately 65 mi. below Hoover Dam.

The revised plans are the result of a recent investigation by a consulting board which reported upon the modifications proposed by the bureau. The revisions utilize all work done to date, and although construction activity was temporarily curtailed on some features, resumption of normal operations is underway.

The structures affected by the revisions are the 225,000-kw. powerplant, the intake structure, and the spillway, all of concrete construction. Design of the main dam, a 3,900,000-cu. yd. earthfill embankment, is not involved in the changes.

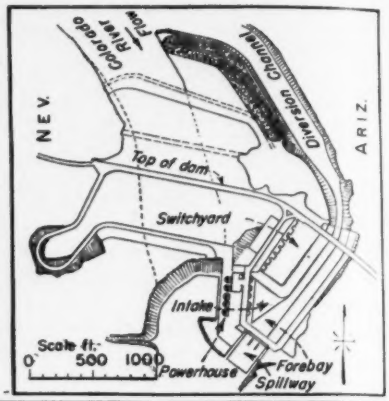
Work on Davis Dam was begun by the Utah Construction Co. in 1942 but was halted in a few months due to the war emergency. Construction was resumed in 1946 by the same firm under a new contract for $21,462,505.

Excavation reveals bad rock

The excavation operations, which have been in progress for some months in the power-plant and forebay area on the east side of the river, have revealed certain foundation weaknesses not completely disclosed by the preliminary investigations. These weaknesses involve areas of severely jointed rock, and zones along which the rock is decayed and crushed.

The bedrock at the site consists of granite, rhyolite and minor amounts of andesite. The predominant foundation rock is granite, somewhat gneissic and severely fractured in places. The bedrock surfaces were encountered in the excavations at predicted levels but detailed studies conducted concurrently with the excavations revealed that, although the degree of weathering decreases with depth, this is not true of the jointing and fracturing.

The broken and somewhat weakened condition of the rock has been known from the beginning, but two sub-parallel zones in which the fracturing is especially severe have proved to be more continuous than was anticipated. One of the zones is exposed in the powerhouse excavation. Both zones dip diagonally away from the river in a southeasterly direction, passing under the intake structure, powerplant, and spillway. The rock



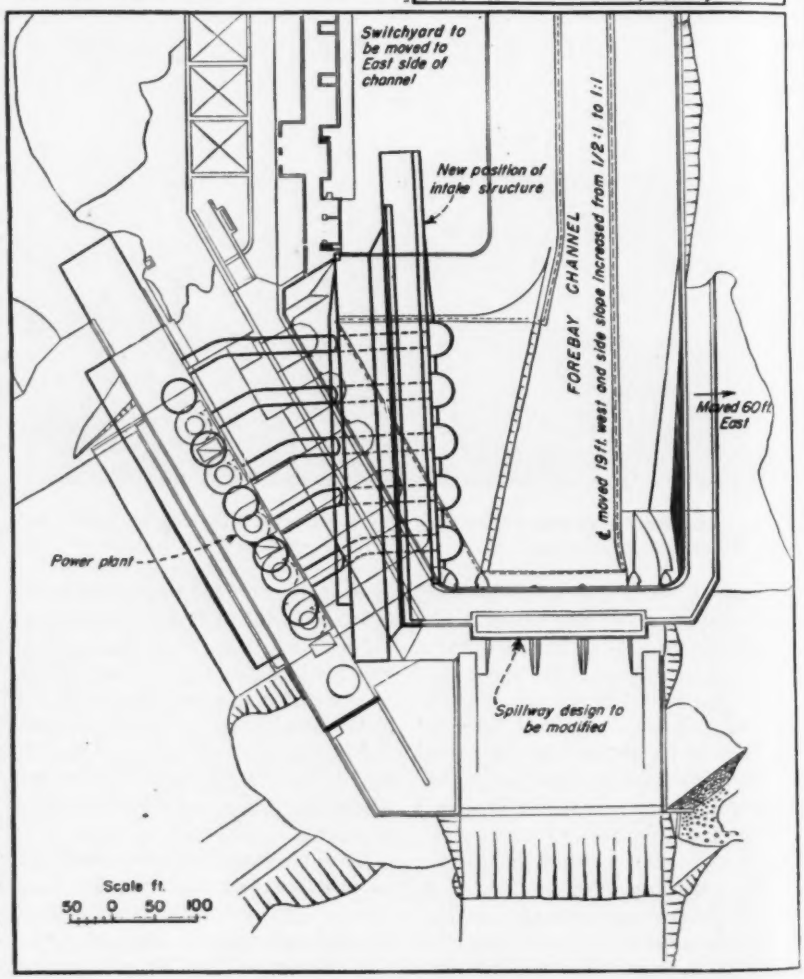

Switchyard to be moved to East side of channel
New position of intake structure
FOREBAY CHANNEL
moved 19 ft. west and side slope increased from 1/2:1 to 1:1
Moved 60 ft. East
Power plant
Spillway design to be modified
Scale ft.
50 0 50 100

Fig. 1. Orientation map (right) and detail sketch (below) of Davis Dam show the structures affected by the design changes resulting from poor rock conditions. These include the intake spillway, switchyard and power plant. There are no changes contemplated for the dam itself.

overlying the zones is less fractured and of better quality.

The intake structure is being shifted to remove the north end from its former position, at which location it would have been underlain by the weakness zone at a point of shallow depth. In the new position the uppermost crushed zone lies at a greater depth beneath the floor of the excavation, and a correspondingly greater thickness of sound rock will be utilized in the foundation of the structure than would have been possible in the original position. The semi-outdoor type power-plant is to be moved slightly upstream to facilitate the entrance of the five 22-foot diameter penstocks leading from the intake structure in its new position.

The subgrade for the spillway structure is to be changed to a horizontal plane and the base of the structure is to be thickened to about 30 ft. A slab footing will be extended upstream a distance of about 50 ft. from the upstream face to secure firm anchorage to bedrock.

The board recommended that a hydraulic-jump structure or other means be employed to keep the rock floor intact to the greatest possible distance and height beyond the toe of the spillway dam. Model testing work is being performed in the Denver laboratories of the bureau to further investigate this recommended revision.

The switchyard, originally located on the west bank of the forebay channel, is being moved to an area about 1,000 ft. east of the channel. The change in the location of the switchyard was made necessary by a flattening of the side slopes of the 4,500-ft.-long forebay channel from ½:1 to 1:1.

Foundation being grouted

The foundation studies have included detailed geologic mapping of surface conditions supplemented by data secured in small diameter diamond core drill holes, 36-in. diameter calyx drill holes and laboratory testing of foundation rock samples. A thorough grouting and foundation treatment program designed to consolidate the foundation rock and increase its bearing strength and imperviousness is being followed in accord with plans approved by the board. The board of five consultants included two geologists and three engineers. The geologists were Charles P. Berkey of Columbia University and J. W. Vanderwilt of Denver. The consulting engineers were Ole Singstad of New York City, John A. Beemer of Inglewood, Calif., and Joseph L. Burkholder, general manager and chief engineer of the San Diego Water Authority.

Fig. 2. One element of the design changes involves deepening of the spillway structure. More than 30 ft. of concrete will be added to the bottom of the spillway which is, in effect, a mass gravity type dam. Equipment in the foreground is working on the additional cut for the spillway foundation. This view looks North through the diversion channel.

Fig. 3. Much hand labor is required in excavating poor rock from the foundation for the gravity wall on the left bank of the forebay channel.

Steel-Frame Houses Built On Assembly Line Principles

***Contents in Brief**—To construct 1,200 one-story, radiant-heated, steel-frame houses with the exterior walls stuccoed on the outside and plastered on the inside, shops were laid out to permit each outside wall to be prefabricated in a single panel, while the roof is assembled as one unit on a second assembly line. In the field, the outside walls and the roof for a three-bedroom dwelling are erected in 40 minutes. About 1,000 man-hours are required for all operations. The project, known as Harundale, is now under way on a 300-acre site near Baltimore, Md.*

INDIVIDUAL steel-frame houses of a new design, featuring radiant heating, are being constructed on a production-line basis for a large project about 5 miles south of Baltimore near the town of Glen Burnie, Md. Methods have been perfected that permit more than 20 percent of the work to be done under roof, with only about 1,000 man-hours required to build a three-bedroom dwelling, including construction of the foundations.

Known as Harundale, the $7,500,000 development consists of 1,200 units, with about 80 percent three-bedroom size and the remainder two bedroom. The project covers nearly 300 acres, of which 64 acres are devoted to park area, 60 acres to streets, 16 acres to a shopping center, and 5 acres to a community center. The homes are all being built for sale, but management of the shopping site will be retained by the developers.

The reasons light-weight structural steel shapes rather than lumber was selected for the framework of the homes, which are all one-story without basement, are outlined by the builders as follows: Steel lends itself more effectively to precision cutting and production-line assembly; the finished home will be more fire resistant; the construction will be more permanent; and cracking of wall plaster will be greatly reduced if not eliminated. Radiant heating was decided upon because this system is expected to provide more uniform heat than with conventional systems and at the same time save floor space

Designed to sell for less than $7,000, including a 60 x 100-ft. lot, the three-bedroom house measures 26 x 38 ft. and provides nearly 1,000 sq. ft. of floor space. The plan is shown in Fig. 2. The two-bedroom home, which is priced at about $6,500, is similar.

In planning the dwellings, the aim

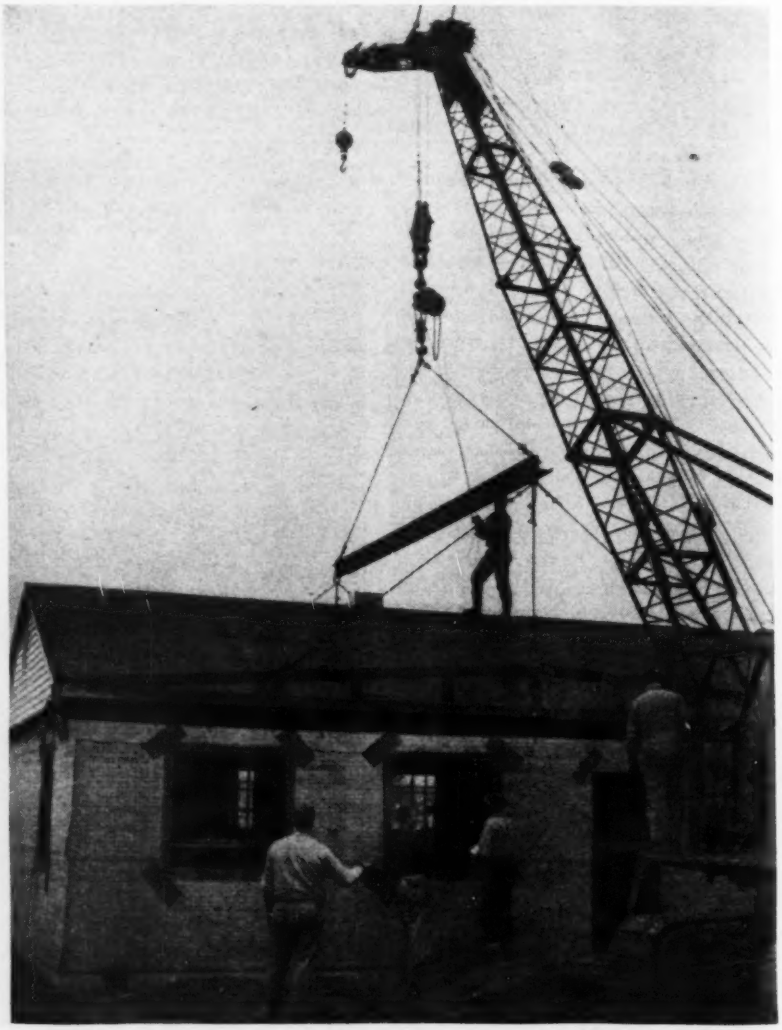


Fig. 1. Following erection of the four exterior walls for one of the 1,200 homes of the Harundale project near Baltimore, the complete roof is set in place by means of a crawler crane with a 45-ft. boom.

Fig. 2. In plan, the typical three-bedroom Harundale house measures 26 by 38 ft. Closet doors are of the horizontal sliding type, increasing the effective size of the rooms. Interior partitions consist of steel studs, metal lath and plaster.

was to obtain a comfortable structure with good heating and insulation characteristics and one that could be built at moderate cost. The design selected calls for a 4-in. thick reinforced concrete floor slab put down on a 6-in. sand fill and supported along all edges on a 12-in. wide grade beam carried down to firm material (Fig. 4). All the radiant heating piping is embedded in the floor slab and consists, for the most part, of $\frac{1}{2}$-in. dia. copper pipe on a 16-in. spacing.

Nailable steel studs used

The principal framing of the exterior walls consists of $3\frac{3}{4}$-in. wide studs spaced 2 ft. c. c. and made up of 16-gage steel, with a groove or V-section at either side to permit nails to be driven into the stud. On the outer side, the wall framework is covered with a 1-in. thickness of glass-fiber insulation, light-weight wire reinforcing mesh backed up with heavy paper, and finally stucco. To the inside face of the studs are added a paper vapor seal, metal lath and three coats of plaster.

An exception to this type of wall construction is in the gables. At these points, aluminum siding is substituted for the wire mesh and stucco. Also, for a number of homes, all of the exterior walls will be surfaced with aluminum siding, while for others, the exterior surfacing will be asbestos cement siding or perhaps brick veneer.

The roof framing consists of light-weight steel trusses on 2-ft. centers. The compression members of the trusses are V-shaped and made of 16-gage material, while the tension members are rods, with the largest $\frac{3}{8}$ in. in diameter.

The roof is surfaced with $\frac{1}{2}$-in. thick plywood, building paper, and asbestos shingles. The ceiling consists of plaster on metal lath, which is tied to the lower chord of the roof trusses.

Interior partitions are made of 16-gage steel studs with metal lath and plaster on either side, doors are of wood, and the windows of steel casement design with inside screens. An individual oil-fired heating unit is provided for each home, a 140-gal. storage tank being installed as part of the system.

Panels fabricated on the site

This design is permitting much of the construction to be done on an assembly-line basis at the site. The possibility of doing considerable prefabrication elsewhere was studied but was considered undesirable, since transportation of large sections for long distances might be expensive because of the special methods that might be required. Frequent delays and interruptions because of transportation difficulties also were considered possible. Moreover, it was felt that any necessary changes in design and in the scheduling of the work, because of variation in material deliveries or for other reasons, could be made most effectively if the prefabrication was done on the site.

Therefore, to provide space for this work and for storage of materials, nine quonset huts, the largest measuring 40 x 180 ft., were purchased and erected at the construction site. One of the larger huts was assigned for assembly of the wall sections and another for production of the entire roof.

Construction supplies arrive by rail

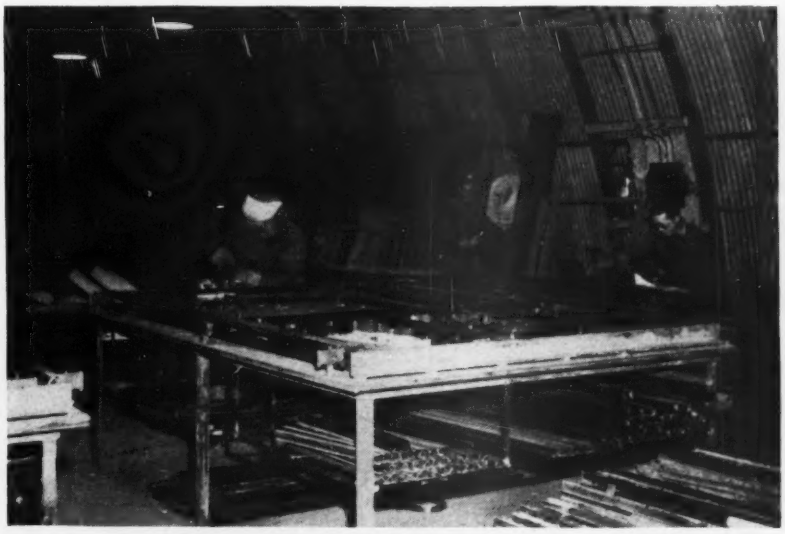


Fig. 3. The steel framework for each exterior wall is assembled in sub-panels prior to assembly as a single large panel.

Fig. 4. Copper pipe for the radiant heating system is placed over the reinforcing mesh for the 4-in. floor slab, and after the concrete has been placed, the mesh and piping are raised sufficiently to embed the latter in the center of the slab.

and truck at the outer end of the first row of huts, and the steel shapes for the wall and roof framework are delivered to the assembly line through the end doors of the huts. Fabrication stockpiles are conveniently located for easy and organized pickup at the start of the assembly lines. Most of the other materials are delivered to the adjacent structures, and after precutting, or any other necessary processing work, are transported to the desired point along the assembly lines through openings in the sidewalls of the huts.

Full-sized wall assembled

Assembly of the framework of the wall sections is accomplished on horizontal jig tables, with blocks, guides and clamps holding each member in accurate position to permit the members to be quickly joined by welding (Fig. 3). On the first jig table are assembled sub-panels of the framework, including the window casements, where these are needed. When completed, these sub-panels, of which the largest measures about 8 x 8 ft., are moved by hand to a larger assembly table, where the framework for the entire wall is completed.

Raised to a vertical position by a steel channel secured temporarily at one side, the large framework is then moved forward by overhead electrical hoists to one of three racks, where on one side of the frame the insulation is fastened by nails driven into the stud grooves and reinforcing for the stucco is secured with large-head tacks welded to the framework by means of welding guns (Fig. 5). Tar paper and metal lath are applied on the other side. From here, the sections are moved outside the hut by the overhead electrical hoists and placed on a large semi-trailer equipped with a special frame designed to carry the four outer walls of one dwelling.

MAN HOURS REQUIRED IN CONSTRUCTING 3-BEDROOM HOUSE

Shop Man-Hours	
Roof	55
Walls	45
Plumbing	20
Heating	17
Carpentry	45
Other	25
Sub total	207
Site Man-Hours (Incl. Foundations)	
Coils and Slab	125
Walls and Roof	25
Partition Framing and lath	65
Plaster, in and out	225
Plumbing and Heating	47
Painting	60
Other	250
Sub total	797
Grand Total	1,004

The normal wall-shop crew consists of an assistant foreman, a saw operator with two helpers cutting the steel shapes to the desired length, six welders employed at the sub-panel tables, and seven welders and an equal number of helpers assembling the large wall sections. The crew finishing the wall panels in the vertical position consists of another assistant foreman, four welding-gun operators, two cutters preparing the necessary materials and twelve workers nailing the materials in place and shifting the wall sections. Normally, these two crews produce the four wall panels for a house in one hour. The larger of the panels weighs about 1,200 lb.

Roof installed as single unit

As the first step in production of the roof, the trusses are fabricated on low tables. The usual procedure is to keep on hand sufficient trusses for about one complete roof.

On removal from the stockpile, the trusses are set with ends resting on

two roller conveyors. When the trusses are brought to the desired position by means of guides located just outside the conveyors, a lightweight steel bearing plate is added under both ends. The diagonal end stay braces are added next, along with the studs for the gable ends.

With the welding of the braces and the ties, the roof assembly becomes a rigid unit and it is rolled forward along the assembly line to the second position for completion of the chimney and addition of the plywood for the roof. In a third position, the roofing paper and asbestos shingles are put on. From here, the roof unit, which may now weigh as much as 4½ tons, is rolled to the end of the conveyors (Fig. 6), where sling cradles are attached at either side to permit two overhead electric hoists to pick up the roof and place it on to a trailer equipped with a special wide bed of steel I-beams.

Fabrication of the trusses is accomplished with four welders and six helpers, while three welders and four workers assemble the trusses into the roof framework. In the second position on the assembly line, eight carpenters and four helpers apply the decking, and six carpenters and three helpers add the shingles and complete the gables. One complete roof section is produced each hour.

Heating pipes also preassembled

With the aid of large templates, the copper piping for the heating system, which is designed to produce a floor temperature of 85 deg. F. with water circulated at 135 deg. F., is also assembled in one of the quonset huts by production-line methods. The copper piping needed for a three-bedroom house totals 795 ft., of which 600 ft. is ½-in. dia., 170 ft. ¾-in., and 25 ft. 1-in. The pipe for one house are assembled in seven large sections with soldered joints and are bent when placed in the template. The crew doing this work consists of one man for the soldering, two cleaners, one man placing the pipe on the template, one bender's helper, and four other workmen. The 9-man crew can assemble the pipe in about one hour.

For ease in transporting the heating-pipe grids to the field, the various sections are tied to light timber frames. After the pipe has been assembled in place and before it is embedded in the concrete floor, the network is tested for leaks at a pressure of 300 psi.

The piping for the plumbing system is pre-assembled in another building. In this work, frames or jigs are used to permit almost the entire system to be assembled in one piece. The 8-man crew doing this work is made up of three plumbers, three helpers and two workmen.

In still another shop, the electrical

Fig. 5. Outer surfacing for the exterior walls, except for stucco, is added on the assembly line. Reinforcing mesh is secured in place with large-head tacks welded to the steel framework by means of welding guns, as shown at right.

Fig. 6. When weather permits, assembly of the roof is completed outside on the end of the assembly line. The hoists are used to raise the roof section above the roller conveyors to allow a trailer to be backed under it.

wiring is attached to the junction boxes or outlet boxes, and many of these are installed in assembling the wall sections. The remainder are added in the field while the interior partitions are being built.

Erection procedure

One of the most time-consuming tasks at the erection site is construction of the floor. In this work, the grade beam is built as a first operation, followed by addition of the sand fill, which is sprinkled and compacted with hand tampers. The single layer of 6 x 6-in. No. 6 reinforcing mesh for the floor is installed beneath the heating grid so that once the concrete has been added over the entire floor, the mesh and the heating coils may be raised to the center of the slab to prevent the pipe from bearing directly on the sand fill. A concrete designed for a 28-day compressive strength of 3,000 psi. and delivered with truck-mounted mixers is used. Finishing is by rotary finishing machines.

To tie the walls to the grade beam, ¾-in. dia. bolts are provided on about 3-ft. spacing. Erection of the four walls and roof requires only about 40 min., using a crawler crane with a 45-ft. boom. The side walls are erected first and are temporarily tied together at either end with a steel strut and two diagonal cables equipped with turnbuckles. Next, the end walls are placed, followed by the roof, which is lowered the last few inches by a chain hoist mounted in the six-point pickup used to handle the section (Fig. 1). The bearing plates attached to the trusses interlock with the tops of the studs in the side walls, and the roof is tied to the walls by welding the ends of the trusses to the studs.

Once the roof is in place, the metal lath for the ceiling is attached to the lower chords of the roof trusses and the partitions are installed. Crews following closely behind do the plastering work and add the stucco on the outside. Glass wool is then blown into the attic to provide a 4-in. layer of insulation over the plastered ceiling. Completion of the home is by conventional methods.

Time studies have shown that with the methods described 1,004 man-hours are required for one three-bedroom structure. A breakdown of the time is given in the accompanying table. It is to be noted that more than one-fifth of the man-hours are spent in the assembly shops.

A total crew of about 500 is employed on the project and a 40-hr. week is being worked. With this force, 4 or 5 homes are now being built each day. It is expected that, once all the required materials are readily available and further experience is gained with the methods described, 10 houses can be constructed daily.

The Harundale project is being financed and constructed by the Byrne Organization, Washington, D. C. E. J. Curry is project manager and A. B. Petersen general superintendent for the Byrne Organization.

Americans Help Restore Libraries in War Devastated Europe

The American Book Center for War Devastated Libraries has issued an interesting report on its first year's work. About 720,000 volumes of books, periodicals, and pamphlets have been shipped abroad. Another 200,000 volumes are almost immediately available for shipment. Pleas from abroad for the continuation of the agency have made it apparent that the need which the ABC was created to fill has not yet been met.

It was determined when physical operations were planned that the ABC could best serve its purpose through the handling and the shipping of large quantities of books to committees in the countries served. These committees, composed of representatives of the various types of libraries, then would be able to allocate printed materials to those institutions that could best use them.

In addition to this basic program the ABC has been able to handle shipments designed for specific institutions abroad. This additional activity has been most important because many institutions abroad have American friends who are deeply interested in helping those particular institutions in this period of crisis. The ABC has thus aided 250 individuals and organizations who have sought assistance in packing and shipping donations.

As an additional supplementary program the ABC has recently been able to supply 20,000 war-time periodical issues which were specifically needed to fill gaps in library files. This filling of specific requests will continue, with from 8,000 to 12,000 issues being provided each month during the year.

The ABC has not had funds sufficient for the payment of transportation charges for materials leaving Washington. Such charges, amounting to very considerable amounts, have been borne by the governments of the countries being served, by American agencies providing aid in rehabilitating wartorn countries, and by UNNRA.

The ABC has been as much concerned with maintaining a high quality of material shipped as it has been in making large and frequent shipments. All publications have been subjected to careful appraisals. An attempt has been made to ship no volume to any country which could not make immediate use of it. The criteria of judgment have been these: Is this volume of lasting usefulness? Is this volume needed in reconstruction?

Emphasis has consistently been placed upon recent publications, especially upon those published in the last ten years.

Thus far 950 institutions and 2,800 individuals have sent contributions. The institutions represented include libraries of every type (with especially heavy contributions from university and special libraries), the university presses, commercial publishing houses, research foundations, and the departments of the federal and state governments. Publishers have supplied more than 40,000 new and very valuable books. Contributions from individuals have varied in size from a single volume to complete libraries.

The book center has its offices in the Library of Congress, Washington, D. C.

Wall Footing Action Poses Enigmas

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***Contents in Brief**—The inadequacy of conventional methods of designing eccentric wall footings is indicated by conditions disclosed on inspection of building substructures. While some footings have failed or settled excessively, others are performing satisfactorily despite the fact that calculations indicate safe soil pressures are considerably exceeded.*

COMPUTATIONS show that soil pressure under the concrete wall footings of an old Texas building, for dead load only, far exceeds assumed safe value. Yet there have been no complaints of settlement. Similarly, without excessive settlement, an eccentric footing of an old Louisiana building, under the weight of a curtain wall alone, exerts about 2,500 lb. per ft. on a soil assumed capable of safely supporting only about 1,200 lb. These and footings that have failed or settled are a few examples of the inadequacy of conventional methods of designing eccentric footings.

While engaged in the design and construction of retail stores throughout the south and southwest, I examined foundations of many adjoining buildings, particularly the wall footings along property lines. In general, these footings were of the usual type, either stepped masonry for the older buildings or concrete for the more modern.

It is doubtful that the old footings were designed for any particular soil pressure. Most likely, a rule-of-thumb construction was followed that had produced satisfactory results in the particular locality, since the majority of business buildings in the smaller towns and cities are of the two-story type on a 20- to 30-ft. front so that construction could be fairly well standardized.

Old footings under-designed

In some instances, use was made along the lot lines of one-sided footings that appear to be of rather extreme design. One case (Fig. 1) occurs in the previously mentioned building in Texas, near the Rio Grande. The bottom of the concrete wall was about 24 ft. below grade, with one intermediate floor for lateral support. There was no reinforcing in the wall or between wall and footing.

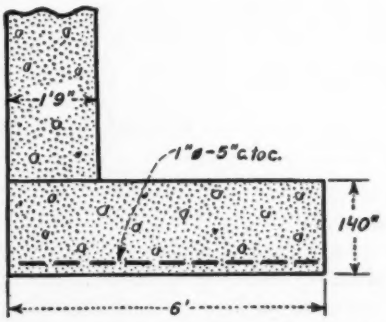


Fig. 1. Concrete footings of an old Texas building theoretically over-stress the soil without damage.

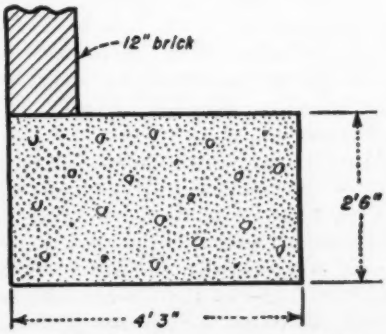


Fig. 2. Brick walls of an old Louisiana building are supported on a concrete base. Calculated soil pressures exceed the assumed safe value.

The safe soil pressure had been taken at 4,000 psf. Calculations indicate that full live load on all floors, producing a total wall load of 23 kips per ft., plus the weight of the reinforced concrete footings, would result in a soil pressure of slightly over 4,000 psf., assuming the load concentric. Evidently, the fact that the footing was eccentric had made no difference to the designer.

Figuring the maximum soil pressure as a straight line variation in the conventional way, we get a maximum of 12,200 psf. at the heel and an uplift of about 4,000 at the toe. Thus, theoretically, the soil pressure is more than three times the assumed safe load. Even assuming dead load alone, the heel pressure is over 9,000 and the toe pressure about 3,000 uplift. Yet there is no evidence of excessive settlement.

Another example occurs in the building in Louisiana, which is situated near a river and subject to flood. It is founded on a poor, transported soil. All foundations are kept as close to the surface as possible because of a quicksand stratum at about 10 ft. below the surface. Local authorities recommended a safe soil pressure of from 1,000 to 1,500 psf., with 1,200 a good average.

The wall footings (Fig. 2) support dead load only, since the building is designed with curtain walls weighing about 2,760 lb. per ft. With the weight of the footing, this results in a heel pressure of 2,510 psf. and a toe uplift of 450. Here also, the footing is eccentric, but the condition is not quite as bad. And again, there is no evidence of foundation settlement.

The point is, in these two cases, that with dead load only the supposed safe bearing value of the soil has been exceeded by more than 100 percent without trouble developing. This

would tend to indicate that soil values as determined by conventional methods are very conservative or that the method of figuring soil pressures under eccentric loads is in error, or both.

To show that all such designs do not turn out as favorably as these, attention is directed to the situation indicated in Fig. 3. It was discovered after settling of a street-front column located on the property line was reported. The footing block in this case was a large stone.

Lessons learned from soil mechanics

It might be well to review a few facts that are known about soil mechanics that may be applied to the examples described. In clay soils, lateral flow or deformations sometimes are very important, but generally in soils of this character the more important element of settlement is consolidation of the clay due to the squeezing out of the moisture. For any estimate of settlement, it is necessary to approximate the preconsolidation load or the load to which the soil has been previously subjected, usually the load of existing overburden.

In the first example described, the foundations were so far below grade that there is no doubt that preconsolidation was a considerable factor in increasing the soil capacity to a figure far greater than the 4,000 psf. assumed. Settlement for a given unit load decreases rapidly as the depth of the loaded area beneath the adjacent ground surface increases. In the second example, the foundation was close to the surface, but there was probably preconsolidation due to previous loadings, since the plot was in the business district where buildings had been standing for years.

In regard to clay soils, building code allowable soil pressures usually are conservative from the standpoint of rupture. The codes do not consider that the ultimate capacity of a soil increases approximately as the square of the depth of the loaded area beneath the adjacent ground surface. On the other hand, while code values may be too conservative in the majority of cases, they might not be sufficiently conservative for a narrow interior wall footing that is at or near the surface.

Many other factors may affect the action of eccentric property-line footings. For example, tests on clay-sand mixtures have shown that friction between the sides of the footing and the soil into which it is cast may account

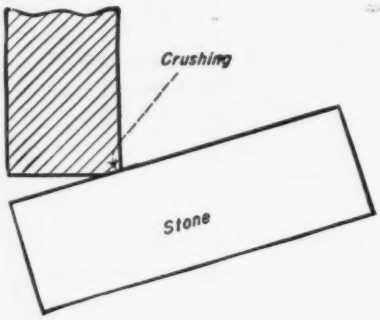


Fig. 3. Settlement of the superstructure accompanied rotation of the stone footing under this wall.

for as much as 45 percent of the applied load. In a great many cases, a new wall is either poured or built against an existing wall and the friction developed between the two is so great that the walls and footings act as a unit as far as the underlying soil pressure is concerned. The intensity of pressure would be a maximum at the property line and decrease in varying degrees to the footing edge, the shape of the bulb of pressure varying according to the character of the soil. In any event, there would not be a distribution of pressure as assumed in the straight line theory.

Thus, we are faced with the problem of what theory to use in design, recognizing that, for small buildings, the soil analysis that would be employed on large projects cannot be justified economically. When footing projections are small, the difference between results obtained with the straight line theory and a more accurate one may not warrant time consuming precise analysis. However, there are times when footings with large projections could be employed to advantage if the pressures to be used could be determined with sufficient accuracy. It would be valuable to have information that would lead to a more accurate solution.

It is worthwhile to keep in mind that, in addition to a thorough knowledge of soil mechanics, the foundation engineer must rely on experience and judgment. A liberal factor of safety will not always guarantee that dangerous settlement will not occur.

Coal Industries Aid Clean-Stream Program

An extensive desilting and coal reclamation system was placed in operation during the month of December at Nanticoke, Pa., by the Susquehanna Collieries. This is the second installation of this type to be constructed in the anthracite coal region, the first being that of the Lehigh Navigation Co. at the Coaldale Colliery. Both of these improvements will play an important part in keeping silt and smaller sizes of coal from the waterways in cooperation with the clean-stream program of the Pennsylvania State Sanitary Water Board, according to Dr. Harry W. Weest, board chairman.

At the Nanticoke Colliery, which produces 3,000 tons of salable coal daily, diversion and reclamation is accomplished by the froth flotation method whereby small sizes and fine coal are recovered and sold, and the silt is diverted to a refuse pile. The colliery has executed a contract with the Luzerne Electric Co. for purchase of the total output of reclaimed fine coal.

A similar pollution control system also will be built at the Glen Burn colliery at Shamokin by the Susquehanna Collieries as soon as operation results at Nanticoke have become available.

Company officials believe that the new design should be based upon an operating experience so that essential changes and improvements may be incorporated in the new plant. Tests reveal that approximately 350 tons of silt and small coal will be kept from the river by this plant. This amount is in addition to 300 tons that is being diverted at present, in cooperation with the water board's program.

The estimated cost of the Nanticoke and Glen Burn installations is about $300,000.

PRA Builds Panama Airport

***Contents in Brief**—Acting as contractor, using the equipment it purchased for building the Trans-Isthmian Highway during the War, the U. S. Public Roads Administration has just completed a new airport for the Republic of Panama. Grading totaling 3,250,000 cu.yd. of red clay and paving involving 143,000 cu.yd. of concrete are the principal construction items. Paving was laid at a rate of 5,000 sq.yd. of 10½-in. slab per day.*

ON THE OLD CHEPO HIGHWAY, approximately 17 miles northeast from its capital city of Panama, the Republic of Panama has built a national airport to rank as one of the finest south of the Rio Grande. Included among its facilities are a 200 x 7,000-ft. runway, 8,000 ft. of 70-ft. taxiway, and aprons serving hangars, freight station and administration building that bring the total paved area to 472,000 sq. yd.

At the request of Panama and under an arrangement with the State Department, the U. S. Public Roads Administration started the excavation and grading for the runway, taxiway, aprons and building sites in April, 1946, and concurrently built a concrete highway 24 ft. in width and 10 miles long, connecting the Trans-Isthmian Highway with the airport. An amendment to the agreement later covered all airport pavement, and work on this began Jan. 20, 1947 and has just been completed.

Located on the coastal plain, the airport has approaches that are excellent for both instrument and visual flying. Prevailing winds are northeast (32 percent) to north (5 percent) and northwest (8 percent) during the local dry season, and from the south and southwest in the rainy season. Wind intensities seldom exceed 15 mph.

Sufficiently far from the blanketing effects of the mountains and only five miles from the ocean, the airport site is said to be free from fogs. Rainfall in the area is seasonal, and at times very heavy, the mean annual rainfall over 10 years of record being approximately 85 in.

Physically located above the flood plains of nearby flashy streams the site will not be subject to inundation, the main fault of a previously selected site nearer the city.

In preparing the site, 150 acres of second growth jungle had to be cleared. Then, working right through the rainy season, the PRA handled some 3,250,000 cu. yd. of excavation, mostly red clay, but including the mining and placing of 220,000 cu. yd. of silt stone for 18-in. thick runway and taxi strip subgrades. This silt stone is a silty material in stone form, between sandstone and a shale, resembling the latter when it is broken up. Compaction in fill was obtained by sheepsfoot rollers, the average density exceeding 95 percent. The PRA used the modern equipment and construction plant it purchased for building the Trans-Isthmian Highway during the war.

The 200 x 7,000-ft. runway, which can easily be extended to 10,000 ft. if ever required, is built with a straight 1.5 percent transverse crown from the center line, with a uniform 1.1 percent longitudinal grade. Paving was placed in 20-ft. strips. The end zones are 12 in. thick, and the runway itself 10½ in. Expansion joints, transversely, are at 100 ft. centers, and each section between joints is divided into four slabs by metal strips.

No longitudinal expansion joints

There are no longitudinal expansion joints, but longitudinal dummy joints are provided in the center of each 20-ft. slab. Concrete pavement has been designed by the PRA for a flexural strength of 600 lb. to carry a 100,000-lb. wheel load. Shoulders are to be 165 ft. wide, of sod, with a 2 percent slope. Runway sub drainage is provided by 6-in. pipe drains. Surface water will dissipate itself over the shoulders.

Taxiways serving the long runway are 12 in. thick with a crown sim-

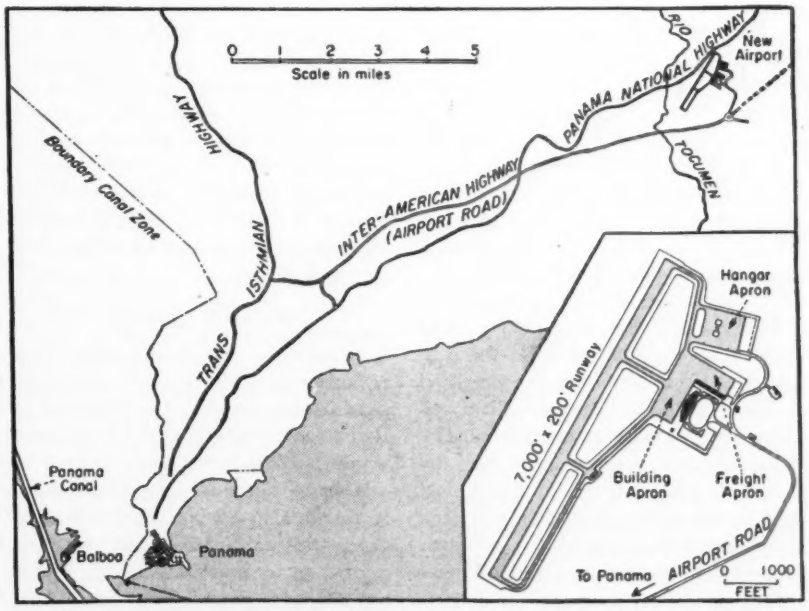


Fig. 1. Panama's new airport is located about 17 miles from the city. Prevailing northeast-southwest winds permit a one-runway layout.

Fig. 2. Looking northeast across the new Panama National Airport as runway paving was in progress.

ilar to the runway. Parking aprons and hangar areas are also 12 in. thick. Roads around the area are 9-in. slabs, with an 8 in. thickness for the automobile parking lot.

All in all, the airport paving involved 143,000 cu.yd. of concrete. The cement, 1,000,000 bags, was obtained in the U. S., and the coarse and fine aggregates, consisting of 125,000 cu.yd. of the former and 80,000 cu.yd. of the latter, are washed river gravel procured about 10 miles from the site. Water was obtained by sinking four wells approximately 150 ft. deep, which produce about 400 gal. per min. These wells are part of the permanent installation since the site is outside of the supply line of Panama City and the Canal Zone.

Paving, which commenced Jan. 20, 1947, was completed by June 1 in time for the formal opening of the airport on that date.

Using two 34-E concrete pavers for about half of the time and a 34-E and a 27-E the remainder, nine-tenths of the runway was placed in 27 days for an average of slightly over 5,000 sq.yd. a day.

Plans for the airport buildings are at present under study by the government authorities, and it is expected that a contract will be awarded in the very near future for architect-engineer services for their design, with a possible completion date of all facilities by Jan. 1, 1949.

The work is being accomplished under the administration of Enrique Jimenez, president of the Republic of Panama. Octavio Vallarino is minister of public works, and F. Hulse is acting airport engineer. For the Public Roads Administration, the work is under the direct supervision of John L. Humbard, division engineer; Paul Thompson, project engineer; A. B. Cook, project superintendent; and Guy Davant, paving superintendent.

Massachusetts Battles Pollution

Massachusett's battle against pollution of harbor and inland waterways is going forward steadily. Within five years, according to Arthur D. Weston, chief sanitary engineer for the State Health Department, the major part of the program will be well advanced. Availability of labor and materials will control the amount of progress that will be made.

Construction of the Metropolitan District Commission's sewage treatment plant on Nut Island in the Boston Harbor is continuing at a normal rate. Plans for another plant on Deer Island are being considered. The total cost of both projects will be about $15,000,000. The city of Boston is preparing plans for a sewage treatment plant at Calf Pasture. When these projects have been finished and are in operation, the waters of Boston harbor will be greatly improved in sanitary quality.

A bill is now before the Massachusetts legislature which will establish the New England Water Pollution Control Compact. It will set up an interstate control commission of five members from each state joining the proposed compact, and would authorize the state planning board to enter into compacts with other New England states.

Interstate compacts

These compacts would deal with pollutional problems of interstate streams—such as the Connecticut River, and with ponds and lakes whose borders touch upon more than one state—such as Lake Champlain. It would also enable joint action to deal with tidal waters closely contacting two or more states. Rhode Island has already passed a compact bill. New Hampshire and Connecticut will probably do so soon.

Pollution problems in the North River in Essex County and in the Taunton River in southeastern Massachusetts—both serious situations—are being cleaned up under a program of sewage treatment plant construction. The city of Taunton has agreed to have a sewage treatment plant in operation by October 1948.

Regarding the Merrimac River, consulting engineers retained by the Public Health Department and the Merrimac River Valley Sewage Board, have recommended construction of six sewage treatment plants at a cost of about $27,500,000.

The city of Worcester had an excellent sewage treatment plant, but during the war acid iron wastes in large quantities from many factories clogged the filters with rust. The city is now building a new plant at a cost of more than $1,000,000.

Fall River has appropriated $1,000,000 for an intercepting sewer which will eliminate the flow of sewage into the mouth of the Taunton River.

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Abington Township Bridge

Sir: In the April 24 issue of *ENR* vol. p. 713, there appears a picture captioned "Delayed Bridge". I wish to make constructive criticism of the information following the caption.

The bridge in question is, as stated, located at the intersection of Old York Road and Edge Hill Road; however, this is in Abington Township, Montgomery County, and not in Jenkintown. Incidentally, Old York Road is U. S. Route 611 and it is felt that recognition should be given the Pennsylvania Department of Highways under whose direction this job is being done. Edge Hill Road, which is also a state highway, intersected with Old York Road at a grade crossing before the construction of the new highway in 1941.

OLIVER L. KING
Township Engineer
Abington, Pa.

Skew Highway Intersections

Sir: The article, "Lower Cost Bridges and How to Get Them," by Fred B. Hartford (*ENR* April 17, vol. p. 588), was timely and thought provoking. His warning against "overzealous requirements for good alinement" should be heeded.

Several years ago, a rough study was made to indicate the effect on cost of the angle of intersection of a highway and railroad at a highway overpass. The investigation was based on dual 24-ft. highways with a 30-ft. parkway between pavements and deck-type structures passing over one railroad track. The costs were the total net cost for the improvement, including earth fill approaches.

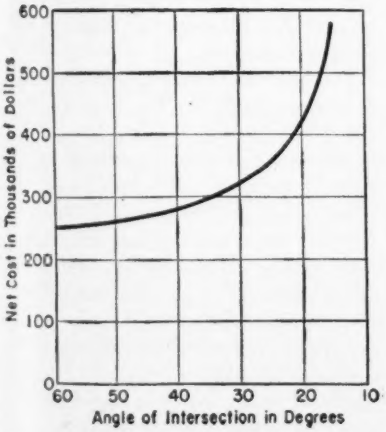


Fig. 1. Costs increase rapidly for a grade-elimination highway bridge as the angle of intersection is decreased.

The relation between cost and angle is shown in Fig. 1. Although these costs are inconsistent with present prices, the curve shows the great increase in cost as the angle of intersection becomes small.

In Fig. 2 is shown how easily very small angles of intersection can be avoided in open country. It is based on deviation from the highway tangent by curves of 4,500-ft. radius with a 500-ft. tangent at the structure. Two curves are given, both plotted against the increase in angle of intersection. One gives the increase in travel distance and the other the maximum deviation from the original highway tangent.

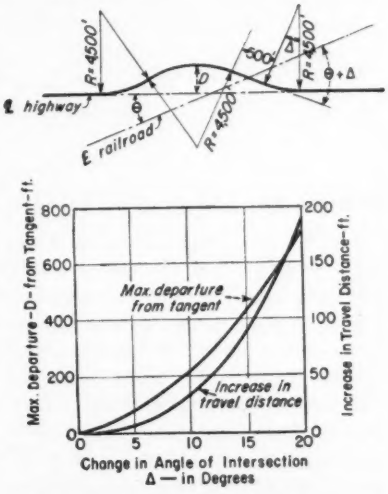


Fig. 2. By means of 4,500-ft. radius curves, the angle of intersection between a highway bridge and railroad may be increased (top). The effect of this increase on departure from the tangent and travel distance is shown in the graph.

By inspection of these two figures, it can be seen that an alinement carried through on a 15-deg. angle of intersection would cost, at the structure, approximately $575,000. The angle could be increased by 15 deg. to 30 deg. with an increase in travel distance of only 88 ft. and with a maximum deviation from the tangent of 430 ft. This new alinement would result in a savings at the structure of about $260,000.

WALLACE F. WILEY
Office of Railroad Crossings
Illinois Division of Highways
Springfield, Ill.

Practical Engineering Education

Sir: The chief obstacle to a proposal that G.I.'s consider the construction industry for training in place of college training is that there is a popular misconception as to the value of a degree which crowns the student with a halo and leads him to believe that he is qualified for his chosen profession after four years of theoretical training. However, if colleges and universities would recognize part-time study, evaluate experience, and grant corresponding degrees in progressive steps, then a long forward step in helping the economic status of the engineering profession would be accomplished.

By so doing, the major problem of expanding an already crammed curriculum will be considerably eased, because the period of progressive education could be extended throughout a larger number of years. In this regard, study by correspondence would assume its rightful place, supplemented by laboratory and field work conducted in cooperation with federal, state, local and private agencies.

Any increase in the period of schooling required for engineering degrees should be vigorously *opposed* by the engineering profession. Such a program will add to the cost of training without corresponding benefits. Every engineer should ask himself the question: "How much of my early schooling has been lost or wasted since my first employment?" From the answer, it should be obvious

that progressive education hand-in-hand with experience will produce the most fruitful results at the least cost for the average engineer.

There are several methods by which one may become a qualified professional engineer. Some of us have had a full-time college course, supplemented by an apprenticeship training period and followed by responsibility. Others may have only three, two, or less years of full-time college work and perhaps one to three years of part-time college work followed by responsibility. Why not recognize this fact and plan accordingly? Some such uniform system should be recognized by colleges, universities, and industries, including the federal, state, city, and local governments. I realize that some steps in this direction have been taken, but so far the recognition of the self-made engineer is far from being realized, and far too much emphasis and recognition is given to the degree *as such*, and far too little recognition given to experience and independent study.

The principal reason why educational institutions are forced to contemplate extending the length of schooling is because of the obsolete teaching methods employed in many instances. This is greatly intensified due to the federal-aid program and resultant G. I. "blitz" courses now being offered. Since one of the major problems in education is how to cover more subject matter in the same or less amount of time, it might be worthwhile to study means which will increase the speed and facility of learning.

Let us consider, for example, the vast accomplishment of our armed forces in training green troops for highly technical functions in modern, mobile, mechanized warfare in World War II. In training our forces, never before has there been such extensive use of visual and auditory training aids, such as films, slides, charts, and diagrams. Never before was such intensive use made of practical training with simulated field conditions. Great efforts were directed into the development of competent instructors. Never before were so many trained so proficiently—so quickly.

Are not some of these methods adaptable to university training? Are not some of these methods superior to the blackboard system? Many veterans of World War II, who like myself have attended military schools and engaged in intensified field training, cannot help but see the contrast between military methods and civilian methods. As a student in the Army Engineer School at Fort Belvoir, Va., on three different occasions, as a battalion and regimental commander of engineer troops, as an inspector of engineer training in the Ninth Service Command, I saw what can be done to train troops efficiently and quickly. The answer is visual-auditory instruction, *immediately* followed by practical application of theory. Having been an engineering student from 1928 to 1932 in a western college, manager of a correspondence school, and now taking extension work with another university, the contrast between military methods and civilian methods is, indeed, striking.

GORDON F. BURK
Denver, Col.

Multiple-Span Suspension Bridges

Sir: In your June 27, 1946, issue, vol. p. 982, D. B. Steinman describes the new multiple-span suspension bridge with tie cables, at Dusseldorf, designed by Carl M. Bohny, and states: "In 1926 the writer hit upon this solution and applied for patent . . . only to learn later that some bridges of this type already existed." This is a situation that occurs all too frequently with engineering patents, and emphasizes that careful search of the literature should be made prior to patent application.

As to multiple-span suspension bridges with tie cables, Gaston Leinekugel le Cocq published in 1911, in his well known work, "Ponts Suspendus", (Vol. I, pp. 208-228 O. Doin et Fils, Paris, 1911) a discussion on the advantages of such structures and also offered a method for their design. A historical account concerning multiple-span suspension bridges with tie cables should emphasize, therefore, the important role of Gaston Leinekugel le Cocq in developing the modern version of these structures. He took up the tied multiple-span suspension bridge idea decades ahead of other engineers, after it had been dormant for half a century. He designed all the existing bridges of this type. His structures suggested the solution for the Dusseldorf bridge problem, and the economy of his bridges constitutes the really important argument for the adoption of this type of structure when circumstances are favorable for their application.

In long-span work, this idea did not pass beyond the study stage. Besides the design studies, mentioned by Dr. Steinman, made by engineers of the San Francisco-Oakland Bay Bridge in 1931 (9,520 ft. and 9,416 ft. long, with 2,380 ft. and 2,354 ft. spans respectively), also the Mackinac Straits Bridge design studies, made in the office of the late Leon S. Moisseiff in 1938, included multiple-span suspension bridges with tie cables of 14,400 ft. and 15,000 ft. length, having 3,600 ft. and 3,000 ft. spans respectively.

LOUIS BALOG
Consulting Engineer
New York, N. Y.

Raising Society Dues

Sir: Your editorial, "Something for Nothing," in the April 3 issue, vol. p. 497, largely with respect to raising dues of members of the American Society of Civil Engineers $5, is thought provoking. It states, among other things, that "an issue of interest to all professional societies is raised by the cool reception accorded to the current plan to raise the dues of members . . ."

Any engineer who is unwilling to have his dues raised $5 for the betterment of his organization certainly must be dubious about its benefits to him. Or, if $5 is of such moment to an engineer, his economic status is not what it should be.

It is difficult to measure the benefits of organizations like the society; they are there nevertheless and thoughtful members know it. Thoughtful members know, too, that those who do most for the society benefit most from it. So many do nothing for their organizations and then complain about receiving no benefits from them. There are too many of the type mentioned in your editorial, "those seeking something for nothing." Things just don't work out that way. Many never learn that age old fact.

HARRY O. LOCHER
Secretary, National Association of River and Harbor Contractors, New York.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Welded Ship Construction

DESIGN AND METHODS OF CONSTRUCTION OF WELDED STEEL MERCHANT VESSELS—Final report of a board of investigation of structural difficulties experienced in construction and operation of welded steel merchant vessels. 164 pp. Obtainable from the Ship Structure Committee, U. S. Coast Guard, Washington 25, D. C.

Those concerned with the construction of the great fleet of merchant vessels built during the war years will find much of interest in this complete report of the investigation of structural difficulties that occurred. The report covers a study of the hull fractures, including eight vessels that have been lost and an additional four that broke in two but were not lost. It comments on the design, materials, construction, operating conditions and concludes with recommendations for improvement.

Much of the book is given over to a statistical report of structural failures on vessels, a summary of research investigations and a survey of past and present shipyard welding practices.

Surveying Texts Revised

THE PRINCIPLES AND PRACTICE OF SURVEYING—Volume II, Higher Surveying. Sixth Edition. By Charles B. Breed and the late George L. Hosmer. 674 pp. John Wylie & Sons, New York 16; and Chapman & Hall, London. $4.50.

SURVEYING THEORY AND PRACTICE — By John C. Tracy. 1,279 pp. John Wylie & & Sons, New York 16; and Chapman & Hall, London. $7.50.

Two well-known books on surveying have appeared in new form since the year 1947 opened. Professor Tracy's "Surveying Theory and Practice" is essentially a new book designed to replace his "Plane Surveying" on which he has been working for nine years. The new book, he states in his preface, "contains all of the old book that the test of time has shown should be retained" plus 500 pages of new material. Among this new material is short chapter on aerial photographic surveys which is designed to give the average surveyor an outline of the fundamental principles involved in that newest branch of surveying.

Prof. Breed's text on higher surveying has been extensively rewritten. Rapid developments in the field of photogrammetric surveying since the last edition appeared in 1938 have made it necessary to entirely rewrite that part of the book.

This book is designed as a comparison to Elementary Surveying, the eighth edition of which was issued in 1945.

Housing Problem Analyzed

THE FUTURE OF HOUSING—By Charles Abrams. 428 pp. Harper & Brothers, New York 16, and London. $5.

The American housing problem is divided by the author into five interrelated categories: the building industry, the slum, home ownership, the housing investment and the role of government. Thus, the essential aims of a program to solve the problem should include revitalizing the building industry to meet the demand for homes, provision of homes for low-income families, slum clearance in urban and rural areas, sound home ownership and stabilization of the real estate pattern.

To carry out the program, according to the author, the following instrumentalities are needed: a federal planning agency to conduct research in city, regional and national planning, to coordinate local and regional planning and to recommend federal aid to local agencies for planning purposes; a national housing agency to supervise all federal housing operations; local planning agencies to promulgate a general plan for housing location, transportation, schools, roads and other public works within a comprehensive plan for the area; and local housing agencies to assume the responsibility for all housing problems and policies at the community level.

Apparently the author believes that the building industry would be revitalized if the local housing authorities or other appropriate agencies would serve as general contractors. Private ownership would follow with the completion of each home. In the author's opinion, the advantages to the cities would be control over location of new developments, over timing of construction to suit market demands, over neighborhood growth and over long-term soundness of investments in homes. Advantages to the home-building industry would include attainment of a dignity equal to its position in the economy, production in quantity and with the efficiency of other major enterprises, and constancy of demand for its product.

The ability of public agencies to tackle large-scale enterprises efficiently, the author holds, could make possible cost decreases through mass production, mass orders, greater uniformity of parts and the most efficient use of labor. Individual home builders would benefit by utilizing these uniform parts. Labor would be assured more steady employment and application of the annual wage would be facilitated.

Other reforms recommended to rectify the building pattern include modernization of codes and more energetic enforcement of the antitrust laws.

Tests on Timber Trusses

TESTS ON TIMBER STRUCTURES FROM GOLDEN GATE INTERNATIONAL EXPOSITION—112 pp. May, 1947 *Proceedings*, American Society of Civil Engineers, 33 W. 39th St., New York 18, N. Y.

Exhaustive tests of heavy timber trusses and structural joints in large timber frames were undertaken after the close of the Golden Gate International Exposition at San Francisco in 1940, using 17 trusses and 37 joints that had been in service in exposition buildings. By making careful observation on these specimens as hydraulic jacks loaded them to destruction in a large testing frame, much information was obtained on deflections, deformations, and ultimate strength.

In 20 tests made with full size trusses, five failed by rupture of the wood members at joint details; six failed at bolted joints and nine failed at connector joints due to types or combinations of stresses not anticipated. The tests brought to light

much detailed information about the weak points in framed timber structures. Conclusions point out the importance of considering tension perpendicular to the grain in the design of timber joints.

An outstanding feature of the report is the exhaustive nature of data presented in tabulations and diagrams as well as in text, from which conclusions are drawn as to the indications of strength or weak points to be guarded against in structures of this type. The tests were carried out by a committee of the San Francisco Section, ASCE, consisting of H. B. Hammill, chairman, H. J. Degenkolb, H. D. Dewell (deceased March 20, 1946), J. J. Gould, and L. H. Nishkian.

Portland Cement

PORTLAND CEMENT TECHNOLOGY—By J. C. Wett. 518 pp. Chemical Publishing Co., Brooklyn, N. Y., $10.

The author states in the introduction—"This is a practical text and reference book. It is written for persons, technical and non-technical, inside and outside the cement and concrete industries, and in fact for everyone sufficiently interested in cement to reach for a book on the subject."

The reviewer feels that the author has rather largely failed in his expressed intentions. He has not prepared a good practical text. Too frequently the equipment used in a step in the manufacturing process is covered by citing but one installation.

There is a marked lack of balance in the amount of attention given to the different phases of production. Thus only 13 pages are used to cover the important matter of raw materials (their prospecting, selection, core drilling, quarry operation, crushing, loading and transporting.) Also the same number of pages is devoted to the rather evolved processes used to reduce the raw materials to the needed particle size and their blending. Yet 18 pages are used to present a method proposed by the author for calculating the proportioning of the several raw materials which may be used.

This lack of balance is even more strikingly evidenced by the chapter on the "Nature of Cement" in which the hydration of cement is also very briefly discussed. This volume of over 500 pages contains hardly a dozen pages describing what cement is, why it acts as it does in the presence of water and what the nature of the reaction products are. Why the demand for low heat, moderate heat of hydration, sulphate resistance and low alkali cements and the nature of these is passed over with little more than presenting the American Society for Testing Materials standards.

The bibliography on the "Theory of Design & Control of Concrete Mixtures" (prepared by the National Ready Mixed Concrete Association) is adequate but the reprinting of the bibliography on the "Constitution of Portland Cement" and "The Setting and Hardening Processes in Portland Cement" published by Bogue in 1927 and 1928 respectively without bringing them up to date leaves a marked void. This is particularly true in view of the vast amount of work on these subjects which has been carried out and the results published.

The outstanding feature of the present volume is the large reproduction of ASTM standards, particularly those relating to concrete, all of which, however, have been available in that society's book of standards.—*Reviewed by* P. H. BATES, *Washington, D. C.*

Miscellaneous Notes on Booklets and Reprints

TO AID REVISERS OF BUILDING CODES, the American Standards Association, 17 E. 45th St., New York 17, N. Y., has prepared a pamphlet entitled "Information on Sources of Material for Use in Preparing and Revising Local Building Codes." This bibliography includes references to 160 important documents, giving the source of each and the price together with a brief summary of the contents. Interested parties may obtain copies from the association.

CAUSE OF INJURY in the operation of concrete mixers and pavers and recommended means for preventing accidents are set forth in a new industrial data sheet (D-Con.7) of the National Safety Council. The bulletin presents methods of guarding concrete mixers and lists essential requirements for job planning, as well as the operating rules for pavers, mixers, engines and general activities related to the maintenance and use of the machines. Copies are available at a small charge from the National Safety Council, 20 North Wacker Drive, Chicago, 6, Ill.

LUBRICATION OF PORTABLE AIR COMPRESSORS is the subject of the May, 1947, issue of *Lubrication*. Copies may be obtained from The Texas Co., 135 E. 42nd St., New York 17, N. Y.

New Engineering Books

HOT-WATER HEATING AND RADIANT HEATING AND RADIANT COOLING—By F. E. Giesecke. 261 pp. Technical Book Co., 110 E. Ninth St., Austin, Texas. $4.

WELDING SYMBOLS—By Vincent C. Gourley. 115 pp. Bruce Publishing Co., 540 N. Milwaukee St., Milwaukee 1, Wis. $2.50.

GERMAN RESEARCH IN WORLD WAR II—By Leslie E. Simon. 218 pp. John Wiley & Sons, New York 16, Chapman & Hall, London. $4.

MANUAL ON AIRFIELDS—127 pp. The Asphalt Institute, 801 Second Ave., New York 17.

THE ROAD OF THE CENTURY—The Story of the New York Central—By Alvin F. Harlow. 447 pp. Creative Age Press, New York, N. Y. $4.

TABLES OF INTEGRALS AND OTHER MATHEMATICAL DATA—By H. B. Dwight. 250 pp. MacMillan Co., New York, N. Y. $2.50.

GUIDE TO THE LITERATURE OF MATHEMATICS AND PHYSICS—By N. G. Parke III. 205 pp. McGraw-Hill Book Co., New York 18, and London. $5.00.

THE STRANGE STORY OF THE QUANTUM—By Banesh Hoffmann. 239 pp. Harper & Bros., New York 16, N. Y. $3.

KNUDSEN: A BIOGRAPHY—By Norman Beasley. 397 pp. Whittlesey House, McGraw-Hill Book Co., New York 18, and London. $3.75.

FUNDATION UND KONSOLIDATION—By C. F. Kollbrunner. 476 pp. Schweizer Druck- und Verlagshaus, Zurich 8, Switzerland. Price 25 francs. Obtainable through Stechert & Hafner, Inc., 31 E. 10th St. New York 3, N. Y.

PUBLIC INVESTMENT AND FULL EMPLOYMENT—348 pp. International Labour Office, 3450 Drummond Street, Montreal 25, Canada. $2.25.

(*Continued on page* 174)

YOUR CHANCES OF GETTING AHEAD

FOR 20 years we have been whittling away the foundations of our economic structure. We have been cutting away the incentives to "get ahead in the world," to increase production and to improve efficiency. Unless this process is reversed soon, we risk the sort of industrial stagnation that currently afflicts Great Britain so disastrously.

How far the whittling has gone is shown by the statement in the center of the page. It shows that everyone's stake in working harder and getting ahead has been reduced sharply since 1929. In that year, anyone who was even moderately successful could look forward to reaping the rewards of his success. If he earned $5,300 annually over a period of 25 years he could retire on a comfortable income of $3,000 per year. Or he could pile up enough capital to go into business for himself. He could fulfill the American dream as phrased by Abraham Lincoln in his first annual message to Congress in 1861:

"The prudent, penniless beginner in the world, labors for wages awhile, saves a surplus with which to buy tools or land for himself, then labors on his own account another while, and at length hires another new beginner to help him. This is the just and generous and prosperous system, which opens the way to all, gives hope to all, and consequent energy and progress, and improvement of condition to all."

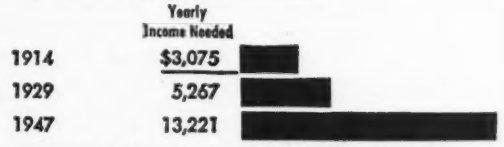
Look at the situation today. To retire on an annual income from investment that will buy as much as $3,000 did in 1929, a young man needs to earn over $13,000 a year for 25 years. That's more than 2½ times the income he would have needed in 1929. The same thing is true of acquiring a stake in a business.

YOUR CHANCES OF GETTING AHEAD

To see how your chances of getting on in the world have changed during the past few decades, the McGraw-Hill Department of Economics has calculated how much it now takes to save enough to acquire a retirement income or a comparable stake in a business, as compared to what it took in 1914 and 1929.

The objective set is an income from investment equal to $3,000 a year in 1929 dollars. It is assumed that the savings required to yield this income are made over a period of twenty-five years. During that period it is also assumed that $4,000 per year (in 1929 dollars) is spent on living expenses.*

Here is how the figures work out:



It now takes more than four times as large an annual income as it did in 1914 to gain a comparable stake. It takes well over twice as much as it did in 1929.

Changes in three factors — federal income taxes, living costs, and interest rates — explain why the income needed has multiplied so. Here's how these factors line up for the three years.

	Federal Income Taxes Married Man, 2 dependents		Cost of Living (Index Numbers 1935-39)	Interest Rate High-grade Corporate Bonds
	$5,000 income	$10,000 income		
1914	$10	$60	71.8	5%
1929	$3	$40	122.5	5%
1947	$589	$1,862	155.0	2½%

Similar calculations show that if we could reduce federal expenditures from $35 billion to $25 billion annually, raise interest rates by one-tenth and lower living costs by 15% — all realistic possibilities if we make the effort — then the income needed to build up such a retirement fund would come down to $9,500. The chances of realizing that goal would then be restored to what they were in 1929.

*Several other factors were omitted from the calculations because they would not have a decisive effect on the results. Thus, existence of social security pensions and retirement funds now reduces the income needed; but if state income taxes were added, the income needed would increase.

Why Try to Succeed?

While the income needed for retirement today has increased 2½ times — or by more than 150% — since 1929, the average person's income has increased only 80%. So the average man's chances of achieving success are really slimmer now than a generation ago.

This 1929-47 trend is something new in America. The average person's chances of getting ahead improved during 1914-29. In that period the dollar income needed for retirement or a stake in business rose by 75%, but the average income rose by 100%. So more people were within striking distance of success and security in 1929 than in 1914. The story has been different since 1929.

Fewer people actually do achieve financial success today. Only 1% of all families now have incomes large enough to build up a retirement fund or a stake in business. In 1929 almost 6% of all families attained a comparable degree of success.

Higher taxes are the most important reason why it takes so much more now to build up a competence. They account for one-half the increase in the amount needed. The other half is explained by higher living costs and lower interest rates.

It is, of course, true that few people ever get into the higher income brackets. So the process of cutting

away the incentives which play such a key role in our economic system affects comparatively few people immediately. It does, however, have a powerful indirect effect on all of us.

Everybody Loses

When half to four-fifths of any additional income of successful people goes to Uncle Sam a heavy drag is obviously put on doing the work to get it. Thus, we stand to lose the benefit of full use of the nation's best brains. By so doing we stifle industrial progress. And the loss in productive efficiency far outweighs the tax revenue the Treasury gains. Carried far enough, the process of stifling economic progress by slashing rewards leads straight to industrial stagnation.

The same process also multiplies the risks of embarking on new capital investment. High taxes rule out all but the most profitable new projects and restrict most expansions to boom times when profits are high. So capital investment follows a boom and bust pattern and, by so doing, contributes much to ups and downs in production and employment.

The Sorry Plight of Britain

The case of Britain today provides an object lesson of how blighted incentives produce industrial stagnation. *Britain's number one economic problem is to get more production. But the tax load there is so heavy it stifles the incentive to produce more.*

A coal miner who works an extra shift pays about a third of his added earnings to the tax collector. And, as the London *Economist* comments, tax rates on business executives are so high that they kill every incentive except that to tax evasion. In short, not only is the incentive to succeed blighted, but so is the incentive to work.

A root-cause of Britain's trouble is this: The cost of an expensive program of social benefits has been piled on top of the heavy costs of paying for past wars and trying to prevent future wars. Tax rates are boosted accordingly. What her experience proves is that the attempt to provide excessive social benefits may defeat itself. It raises the tax burden on rich and poor alike and smothers the incentive to work. So the underlying basis of all economic benefits—production—is eaten away.

We in the U. S. haven't traveled as far down the stagnation road as Britain has. Taxes amount to about 26% of national income here as against about 45% there. But, unless we start soon to build up incentives to do better work, instead of whittling them away as we have been doing, we will catch up with Britain fast.

It's Late but Not Too Late

Can anything be done? Decidedly yes, *particularly by tax reform and reduction in the cost of living.* As far as interest rates are concerned, any large increase would raise excessively the cost of carrying our war-swollen national debt, and hence raise taxes. But some increase in what are now excessively low interest rates may well be both feasible and desirable.

Action on the tax front is the first order of business. Our jerry-built tax structure is the thing that is chiefly responsible for cutting the incentives to work harder. Two things are important: 1) Government spending must be pared to the bone; 2) The tax system must be completely overhauled to remove the shackles on all-out production.

The 56th editorial in this series, published in March, outlined major steps that need to be taken in remodeling federal taxes in order to increase incentives to individual and business enterprise. *The revenue bill now before Congress is no more than a short step in the right direction. Much more must be done to clear the way for high production and rising living standards.*

Lifting the blight which taxes now place on incentives would help cut the high cost of living. It would stimulate greater production and greater efficiency. But a further step is necessary. Part of the benefits of improved efficiency must be passed on to consumers in the form of lower prices.

In the past few years we have been following precisely the opposite course. In many cases wages have been increased all out of proportion to increased productivity. Result—soaring prices and a severe squeeze of the consumer, to which some greedy exploitation of war-created shortages has also contributed.

To Give Ability a Chance

Our basic and most crucial problem is to get back on the track which leads to higher production and improved living standards all along the line. We got off that track in the 30's. Then, we started scrambling for larger slices of the same pie instead of trying to produce a larger pie. Now the process of getting back on the track is greatly complicated by the tremendous tax burden growing out of the war.

Yet it's not too late to turn back from the road that leads to industrial stagnation. As the statement in the center of the page shows, we could restore the odds of getting ahead to what they were in 1929. Cutting the federal budget to $25 billion a year and putting the tax structure in good order are the crucial first steps.

By taking these steps soon, Congress can go far to restore the incentives to hard work and efficiency which have been so largely washed away in the past 20 years. If they are not taken the American dream of getting ahead by hard and effective work will exist only in the history books, and our children will inherit from us an economic order without opportunity, without hope, without individual liberty.

James H. McGraw, Jr.

President McGraw-Hill Publishing Company, Inc.

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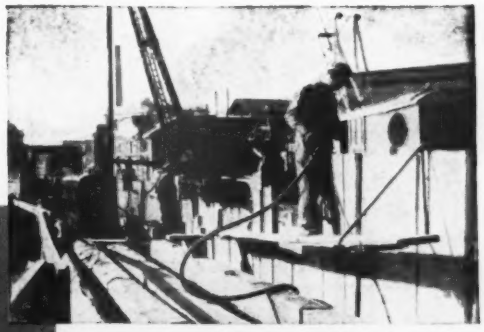

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MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

CEMENT, AGGREGATE, READY-MIXED CONCRETE — F. O. B. CITY

	PORTLAND CEMENT (Per bbl. C/L lots incl. $1.00 per bbl. for bags, cash. dis. not deducted)			SAND AND GRAVEL (Per ton, carload lots)			CRUSHED STONE (Per ton, carload lots)		CRUSHED SLAG (Per ton, carload lots, f.o.b. plant)		CONCRETE BLOCK 8x8x16-in.; truckload del.; per block		CONCRETE Ready Mixed 1:2:4, over 50 c.y. del.
	Cloth	Paper	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand grav.	Lt.wgt.Agg.	
Atlanta	$3.62	$2.77	$2.52	....	....	....	....	....	....	....	$0.1725	....	$10.05
Baltimore	3.46	2.61	2.36	$2.10‡	$2.10‡	$1.60‡	$2.20‡	$2.20‡	$2.20‡	$2.20‡	.145	$0.145*w*	8.35
Birmingham	3.42*mm*	2.57*mm*	2.32*mm*	2.06	2.06	1.63	2.50	2.50	1.00	1.20	.1425	.1425	6.95
Boston	3.88	3.03	2.78	1.50‡	1.50‡	1.40‡	1.25	1.35	....	....	.186	.195*w*	8.50*m*
Chicago	3.85	3.00	2.75	2.50‡*d*	2.50‡*d*	2.75‡*d*	2.50‡*d*	2.50‡*d*	2.00‡	2.00‡	.195	.195*x*	....
Cincinnati	3.34	2.49	2.24	....	....	....	....	....	....	....	....	....	....
Cleveland	3.50	2.65	2.40	2.50‡	2.50‡	1.15*ll*	3.20‡	3.20‡	2.40	2.40	....	.20	10.15
Dallas	3.32	2.47	2.22	1.80	1.80	1.60	1.89	1.99	....	....	.0775*p*	....	8.68
Denver	3.93	3.08	2.83	1.85	2.00	1.15	....	....	....	....	....	.2175*w*	9.00
Detroit	3.40	2.55	2.30	2.75	2.75	2.50	2.50	2.50	2.50‡	2.50‡	.16	.17*w*	8.30*kk*
Kansas City	....	....	....	2.00	....	1.40	2.00	2.00	....	....	.16	.16*wy*	8.50*n*
Los Angeles	3.30*ee*	2.80	2.40	1.55	1.55	1.40	1.40*f*	1.40*f*	1.40*f*	1.40*f*	.125*bb*	.14*bb*	8.75*m*
Minneapolis	3.70*nn*	2.85*nn*	2.60*nn*	1.90*h*‡	1.90*h*‡	1.00*h*‡	1.90*h*‡	1.90*h*‡	....	....	.183*ff*	....	9.05*kk*
Montreal	....	2.05*r*	1.90*r*	1.78‡*s*	1.78‡*s*	1.10*t*	.95*ct*	1.05*ct*	....	....	.1391	.1515	7.75*s*
New Orleans	3.28	2.43	2.18	1.82	1.82	1.62	....	....	.90	1.15	.23	....	9.92
New York	4.36‡	3.36‡	....	1.85*de*	1.85*de*	1.30*de*	1.90*de*	1.90*de*	....	....	.20*ii*	.17*uccii*	9.15*k*
Philadelphia	3.32*oo*	2.47*oo*	2.22*oo*	1.55‡	1.65‡	1.25‡	1.90‡	1.95‡	1.50	1.50	.155	.155*w*	8.80
Pittsburgh	3.36*oo*	2.51*oo*	2.26*oo*	1.85‡	1.85‡	2.15‡	2.35‡	2.35‡	1.80	1.80	.21*z*	.21*z*	9.85
St. Louis	3.52*o*	2.67*o*	2.42*o*	2.25‡*o*	2.25‡*o*	2.25‡*o*	1.25/1.95	1.25/1.95	....	....	.175	.22*yo*	9.80
San Francisco	3.54*jj*	2.64	2.24	1.56	1.56	1.66	1.66	....	....	....	....	.25*y*	9.05
Seattle	3.35*gg*	3.10	2.80	2.50*d*‡*o*	2.50*d*‡*o*	2.50*d*‡*o*	3.00‡*od*	3.00‡*od*	....	....	.18	....	8.50

‡ Delivered. *b* 20c. per bbl. off for payment by 10th of following month. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* Truck Lots. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount of 2 percent for cash in 10 days. *l* 2000 lb. concrete. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 5½ x 8 x 12 in. *q* 5 cu. yds. or more. *r* 10% per bbl. off cash 20 days. *s* 8% sales tax included. *t* 8% sales tax not included. *w* Cinder. *x* Waylite. *y* Haydite. *z* Celocrete. *aa* Pumice. *bb* 4 x 8 x 12 in. *cc* Also 8 x 18 in. *dd* Prices quoted are LCL. Carload lots not available. *ee* 20c. refund for each returnable bag. *ff* 8 x 8 x 18 in. *gg* 10c. refund for each returnable bag. *ii* Yard price. *kk* 2500 lb. compression strength. *jj* 30¢ refund for each returnable bag. *ll* Price at plant.

Corrections. *mm* Prices unchanged at June level since Sept. 1946. *nn* Prices unchanged at June level since April 1947. *oo* Prices unchanged at June level since Feb. 1947.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount. 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICE BASES AT CEMENT MILL

Charge for bags not included. For cloth bags, add $1.00 per bbl.; 25c. refund allowed for each returnable bag; for paper bags add 20c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$2.00	$1.95	Ironton, Ohio	$1.95*	$1.90*	Universal, Pa.	$2.00	$1.95
Hannibal, Mo.	2.00	1.95	Northampton, Pa.	1.90	1.85	Waco, Tex. (Plus 9c. tax in Tex.)	1.85	1.80
Independence, Kans.	2.00	1.95	Richard City, Tenn.	2.00	1.95	Montreal City (Discount 10c. per bbl. 20 days)	1.78	1.78
			Steelton, Minn.	2.10	2.05			

* Destination price base effective Sept. 17, 1945

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS — F. O. B. CITY

	PAVING BRICK AND BLOCK			PAVING ASPHALT (Per ton, less than 80 penetration)		ASPHALT BINDERS—FLUXES (Per gal., 80–300 penetration)		CUTBACK ASPHALT (Per ton)		ROAD OIL (Per gal.)	ASPHALT EMULSION (Quick-breaking) (Per gal.)	
	Granite per M lots of 50,000 4x4x8 in.	Brick per M 3x4x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	$35.00	$2.25	$14.00	.....	$0.074	.....	$0.0806*h*	.....	$0.0781	$0.0806	.....
Baltimore	160.00‡	60.50‡	95.00*m*	16.00	$25.00	.075	$0.11	15.00	$25.00	.075	.085	$0.15
Birmingham	.....	32.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Boston	85.00	59.00	3.75	17.00	29.50	.0723	.1447	18.00	31.00	.07	.0907	.18
Chicago	150.00‡	65.00/68.00*e*‡	2.97/4.10*d*‡	17.00/18.00*b*	25.00/25.50*b*	15.50*bg*	24.00/24.50*bg*	.0775/.085*hh*	.1625/.1655*hh*	.0625/.065*b*	.0925/.1025*b*	.14/.165*b*
Cincinnati	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cleveland	150.00	49.00*t*	3.43*s*	18.00	26.00	17.00*g*	25.00*g*	.085*h*	.17*h*	.....	.105	.20
Dallas	.....	40.00	.....	16.95	29.15	.0686	.1225	20.00	37.60	.06	.0725	.135
Denver	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Detroit	.....	63.00*x*	.....	20.00*f*	26.00*f*	18.40*g*	24.40*g*	.0811*h*	.128*h*	.075	.1085	.1522
Kansas City	.....	40.00	.....	17.00	24.00	16.00*g*	23.00	.08*h*	.13*h*	.....	.12	.16
Los Angeles	.....	60.00	.....	9.50*b*	24.00*b*	10.00*bg*	24.50*bg*	10.00*b*	.....	.04*b*	.10*b*	.20*b*
Minneapolis	.....	.....	2.39*d*	.....	.....	.....	.....	.....	.....	.....	.....	.....
Montreal	.....	.....	.....	16.60*k*	24.25*k*	.1160*k*	.1485*k*	.115*hk*	.135*hk*	.08*k*	.135*k*	.188*k*
New Orleans	.....	.....	.....	13.50*a*	.....*s*	12.50*g*	.....*s*	6.75	.....*s*	.055	.08	.13
New York	.....	.....	2.50*n*	20.68	32.85*s*	19.68*g*	38.68*g*	.0857*h*	.1669*h*	.0807	.0855	.1643
Philadelphia	150.00	62.00	4.06	19.00	.....	17.00	.....	.08*h*	.....	.....	14.00*gr*	.....
Pittsburgh	135.00	39.75	3.90	19.00	27.00	.095	.185	22.00	34.00	.075	.085	.15
St. Louis	.....	42.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Francisco	.....	47.75*c*	.....	11.75	25.25*w*	11.75*g*	.....	13.75	.....	.....	.0525	.1225*h*
Seattle	.....	.....	.....	11.75*i*	22.75*i*	9.50	.....	12.25*i*	15.25	10.90*i*	.0525*h*	.0625

‡ Delivered. *a* F.o.b. Baton Rouge. *b* F.o.b. Refinery. *c* 2¼ x 8½ x 4 in. *d* 2-in. interior block, 6-lb. treatment. *e* 3½ x 4 x 8½. *f* Mexican. *g* Per ton. *h* Per gallon. *i* F.o.b. Martines. *j* 3 x 3½ x 8½ in. *k* Tax included. *m* Per thousand. *n* 2 in., treatment 6 lb. *r* February 1943 prices, none later available. *s* Drums not available. *t* Truck deliveries in Greater Cleveland. *w* Shipped in double head wood barrels. *x* 3 in. block. *z* Truck deliveries in Detroit $75.00.

This tire "wears" nylons for extra shock protection

WHEN heavily loaded tires like the B. F. Goodrich Super Traction shown above strike rocks or jagged stumps, the terrific impact may cause a bad bruise—or even a blow-out in a new tire.

A special shock shield to protect the rayon cord body by absorbing and *distributing* impact has been the B. F. Goodrich answer to the problem of impact bruises. Now, B. F. Goodrich is building shock shields of *nylon* for even greater protection against bruising.

In off-the-road tires a *double nylon shock shield* is used. It consists of four layers of nylon cords between the tread and the plies. These nylon layers are in pairs, cords in each pair running at scientifically determined angles to the cords in the other pair to give "balanced" strength.

The strong, elastic nylon cords in each layer run parallel, fully insulated in live rubber. Under impact, the cords in the shields stretch together, *not* across each other, and return to their original position. Because of this principle, sharp impacts are *distributed,* absorbed . . . the rayon cord body actually shielded from shock!

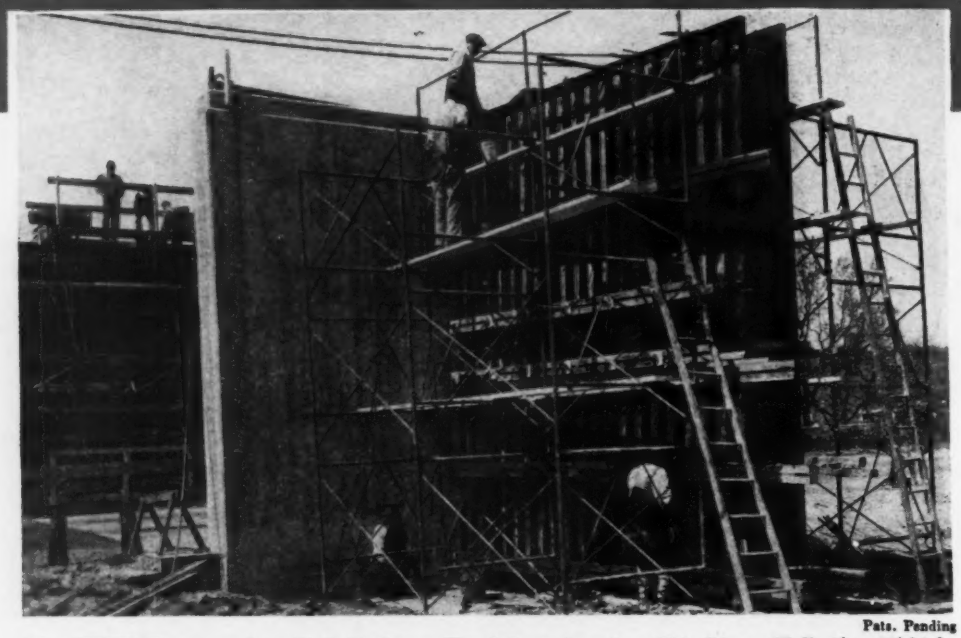
No make of tire other than B. F. Goodrich gives you the added protection of the double nylon shock shield . . . the additional savings through: (1) longer tire life; (2) increased number of recappable tires; (3) increased bruise resistance; and (4) less danger of tread separation.

Find out how B. F. Goodrich can help save you money on tires. See the B. F. Goodrich dealer or write us direct. *The B. F. Goodrich Company, Akron, Ohio.*

Truck Tires BY

B.F. Goodrich

Only HALF the Costs with Atlas SPEED Forms



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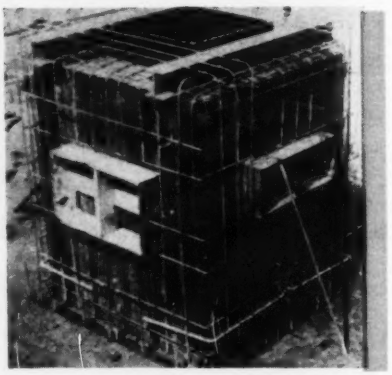
Atlas SPEED Forms used on U. S. Engineers Flood Control project, Ohio River—Walls 8' to 27' high. W. L. Johnson, General Contractors, Cincinnati, Ohio

New Technique in Concrete Construction

Job studies, layouts, comparative cost data, supervision and Atlas SPEED Forms . . . Cut form labor costs to a new low minimum—50% and more on walls, and up to 75% on slabs, is not unusual by any comparison.

Steel Forms easy to erect, strip and move—Lightweight, simple to handle. A *designed steel form* with strength built in—Good for re-use indefinitely without repair.

When Contractors like H. K. Ferguson, F. H. McGraw, Lord Electric, V. Barletta, and many others, place repeat order after order with us, on job after job, you can be sure of this—Atlas SPEED Forms *must* be RIGHT



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SPEED Forms can be made interchangeable for walls and slabs—Finish is uniform—no knot-holes or grain marks.

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ATLAS LABOR-SAVING *SPEED* FORMS

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES–PLATE/	REINF. BARS billet *be*/	RIVETS ½-in. structural/	WIRE NAILS Base *d*/	SHEET PILING Base/	STEEL RAILS Per Net Ton Standard	Light	Re-rolled	TRACK SUPPLIES/ Angle Bars	Std Spikes *c*	Tie Plates *c*	Track Bolts
Birmingham	$2.50	$2.45	$5.25	$3.75/4.50	....	$50.00	$57.00	Not	$3.00	$3.65/4.50	$2.80	$6.50
Chicago	2.50	2.45	5.25	3.75/4.50	$3.00	.....	.....	avail-	3.00	3.65/4.50	2.80	6.50
Pittsburgh	2.50	2.45	5.25	3.75/4.50	3.00	50.00	57.00	able	3.00	3.65/4.50	2.80	6.50
Buffalo	2.50	2.45	....	....	3.00	.....	.....	....	....	....	2.80	....
Cleveland	....	2.45	5.25	3.75/4.50	....	.....	.....	....	....	....	....	....
Youngstown	....	2.45	....	....	....	.....	.....	....	....	3.65/4.50	....	....
Detroit	....	....	....	....	....	.....	.....	....	....	....	....	....
Gulf ports	....	....	....	....	....	.....	.....	....	....	....	....	....
Geneva	2.675‡	....	....	....	....	.....	.....	....	....	....	....	....
Los Angeles	3.17/3.41‡	3.025‡	....	....	....	.....	.....	....	....	....	....	....

‡ Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates alone. Steelton, Pa., on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 percl. *e* Mill lengths. Add 50¢ for cut lengths. *f* Per 100 lbs.

IRON AND STEEL PRODUCTS—F. O. B. WAREHOUSE, PER 100 LBS., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS/ Per 100 lb., base price *u* 5 tons to carload lot *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH Per 100 sq. yd., carload lots Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq. ft., carload lots 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	¼ 6x6 in., No. 6 & 6 wires Per 100 s. f.	SHEET PILING Per 100 lb. base price
Atlanta	$4.65‡	$4.75‡	$4.75‡	$.025	$.10	$31.00	$33.00	$2.00	$1.50	$2.12	$3.35
Baltimore	4.25	3.635	....	....	.10	29.00	31.00	1.88	1.42	2.00	3.25
Birmingham	4.05	3.50	3.50	.05	.10	37.50*p*	40.50*p*	1.98	1.49	2.10	....
Boston	4.47‡	4.194‡	3.39*e*	$20 C.L.	.10/.15	26.00*x*	28.00*x*	1.94	1.46	2.05	3.443
Chicago	4.05	3.90	3.20	.05	.05	24.00‡	26.00‡	1.85	1.40	1.96	3.00*a*
Cincinnati	....	....	....	....	....	.....	.....	1.87	1.41	1.96	....
Cleveland	4.311	3.40*v*	....	.025	.10	26.00	28.00	1.84	1.40	1.95	....
Dallas	6.00	5.00	5.00	....	....	31.00	35.00	2.11	1.57	2.22	....
Denver	5.50	4.97*e*	....	....	....	36.00	41.00*g*	2.15	1.60	2.28	....
Detroit	4.42‡	3.591‡	3.591‡	....	.10	38.00‡	42.00‡	1.86	1.41	1.97	3.31
Kansas City	4.85	2.95*cd*	2.80*cd*	.0	.05	30.00	32.00	1.96	1.48	2.08	3.0826*a*
Los Angeles	5.20*f*	3.025	2.875	.03	.05	23.00	27.50	2.11	1.57	2.24	5.50
Minneapolis	4.434‡	4.224*dy*	4.224*dy*	.0	.10	26.50	28.50	1.98	1.49	2.10	3.47*d*
Montreal	4.55*i*	4.20*i*	4.20*i*	....	....	36.00*hi*	38.70*hi*	2.87	3.54*i*	2.96*im*	73.00*jd*
New Orleans	4.408‡	4.18*o*	....	.05	.10	27.50	29.50	2.00	1.50	2.12	3.125
New York	4.17*r*	3.85	....	....	.10/.15	30.50*st*	32.505*st*	1.97	1.44	2.19	3.00*a*
Philadelphia	3.97	4.24	....	....	....	22.50‡	24.75‡	1.89	1.43	2.00	3.41
Pittsburgh	3.80	3.20	3.20	.05	.10	23.00	26.80	1.77	1.35	1.88	3.00*a*
St. Louis	4.249‡	3.94‡	3.94‡	.0	.05	34.00	36.00	1.87	1.42	1.97	....
San Francisco	4.90	3.83	2.875	.025	.10	28.00	31.50	2.11	1.57	2.24	4.50
Seattle	3.368*e*	3.368*e*	....	....	....	43.00*w*	44.00*w*	2.11	1.57	2.24	4.37*e*

‡ Delivered. *a* Mill prices. *b* 1–5 tons, add 35c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. customer's spur. *f* Includes delivery in free delivery zone. *g* High scrap steel prices cut former 15c. differences between new billet and rail steel in many mills. *h* List price. *i* Plus Dominion and Province sales tax. *j* Price per ton. *m* Per sq. yd. *o* 5 to 15 tons Base. *p* Deliveries of 5000 sq. yd. or less. *q* ¾ in. standard ribbed. *r* 5 tons or over. *s* LCL. *t* Asphalt coated. *u* Note: Revised size extras—¾ in. and over 15¢, ⅝ in. 20¢, ½ in. 30¢ ⅜ in. 50¢, ¼ in. $1.20. *v* $2.99 for 25 tons and over. *w* Copper bearing. *x* June price effective Jan. 7, 1947. *y* June price effective Feb. 15, 1947.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in. *a*	VITRIFIED SEWER PIPE Per foot, Delivered std. 8 in. s.s.	std. 12 in. s.s.	24 in.	36 in.	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTMC 14–41 12 in.	24 in.	WROUGHT STEEL PIPE (Full standard weight, f.o.b. destination *s*) 1 to 3 in., Butt Weld Black %	Galv. %	3½ to 6 in., Lap Weld Black %	Galv. %
Atlanta	$76.28	$0.43	$0.67	$3.39	....	$114.00	$140.00	$0.45	$2.00	53.2	40.2	50.7	37.2
Baltimore	80.60	.35	.60	2.70	$7.25	160.00	200.00	.85	2.25	56.9	43.9	54.4	40.9
Birmingham	71.00	.375	.675	3.06	....	210.00‡	375.00‡	.75	2.00	53.2	40.2	50.7	37.2
Boston	83.20	.392*m*	.756*m*	3.15*m*	7.995*m*	170.00‡*m*	265.00‡*m*	.53*h*	2.04*h*	58.2	42.2	52.7	39.2
Chicago	81.56	.49	.95	3.60	....	200.00‡	270.00‡	.65	2.25	59.0*t*	46.0*t*	55.5*t*	42.0*t*
Cincinnati	80.36	....	....	....	....	.....	.....	.54	2.00	57.4	44.4	54.9	41.4
Cleveland	82.04	.329	.6345	2.79	7.38	121.00	190.00	.58	2.25	59.65	46.65	57.15	43.65
Dallas	83.78	.375	.675	2.70	6.20	109.00	131.00	.45	1.45	51.3	38.3	48.8	35.3
Denver	88.62	.38	.68	2.84	....	154.00	295.00	.64	2.25	49.4	36.4	46.7	33.2
Detroit	82.04	.455	.8775	3.69	8.50*l*	170.00‡*m*	263.00‡	.50	1.90	57.9	44.9	55.4	41.9
Kansas City	83.12	.345	.625	2.48	7.00	175.00	312.00*m*	.50	1.70	54.7	41.7	51.8	38.3
Los Angeles	95.00	.414†	.745†	2.988	7.47	157.00	260.00	1.25	2.50	....	....	....	....
Minneapolis	85.10	.51†*o*	.98†*o*	3.95†*o*	....	.....	.....	1.04*h*	2.67*h*	54.8	41.8	51.9	38.4
Montreal	78.20	.68	1.20	3.94	6.38*e*	.48*p*	.68*p*	72.00*jk*	218.00*jk*	....	....	....	....
New Orleans	78.68	.40	.72	3.06	....	.....	.....	.55	1.95	52.8	39.8	50.3	36.8
New York	79.80	.55	1.05	4.14	9.74	.....	.....	.70	2.00	56.2	43.2	53.7	40.2
Philadelphia	78.20	.50	.95	3.95	9.75	220.00	275.00	.90*h*	2.75*h*	56.7	43.7	54.2	40.7
Pittsburgh	82.52	.322†*m*	.631†*m*	2.70†*m*	6.625*m*	124.20	193.90	1.05*h*	2.50*gh*	60.0*t*	47.0*t*	57.5*t*	44.0*t*
St. Louis	79.88	.40*n*	.72*n*	2.83*n*	6.53*n*	105.80	212.00	1.20*h*	2.55*h*	56.6	43.6	53.2	39.7
San Francisco	95.00	.4375*d*	.7875*d*	3.15	7.875	159.00	265.00	.69	2.85	....	....	....	....
Seattle	96.80	.45*b*	.81*b*	....	....	.....	.....	.595*f*	1.98*f*	....	....	....	....

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier, C/L lots, Burlington, N. J. (base) $70.00. Based on existing freight rates; subject to rate change. Gas pipe and class A, $5 per ton additional. 4 in., $5 per ton additional, 30 in. and larger, usually $1 per ton less. *b* Double strength. *d* List. *e* 30 in. *f* Less 2% for cash. *g* Culvert pipe. *h* Reinforced. *j* Centri-spun. *k* Per 100 feet. *m* Truck delivery. *n* Less 3% for cash. *o* Since carload lots are not available at this time, listed price is based on LCL (no minimum). *p* Less than 5 ton loads, price per foot. *s* Discounts from standard list consumers carload prices. Base price approx. $200 per net ton. List prices per ft.: ¼ in., 8½c.; ⅜ in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92; 3 percent tax on transportation costs not included. *t* Within switching limits.

WROUGHT IRON PIPE: List prices per ft. same as wrought steel pipe. Discount for Pittsburgh base. Butt weld — 1 in. and 1¼ in. black, 34, galv., 16; 1¼ in. black, 38, galv., 18½; 2 in. black, 37½, galv., 18. Lap weld — 2½ in. to 3½ in. black, 31½, galv., 14½; 4½ in. to 8 in. black, 32½, galv., 17. Freight rates to destination to be added to name delivered price.

LUMBER, TIMBER, PLYWOOD—PER M FT., B.M., CARLOAD LOTS F. O. B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face) *All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)*									LONG LEAF Y. P. Merchantable grade up to 20 ft.		PLYWOOD Rail freight increment (See note for base price)	
	1x6 s'n	1x8 s'n	2x4 s'n	2x6 s'n	2x8 s'n	2x10 s'n	3x12 #A	6x12 #A	12x12 #A	2x12 #A	12x12 #A	5/8"	3/4"
Atlanta	**$70.00**	**$70.00**	**$65.00**	**$65.00**	**$65.00**	**$65.00**	**$88.50**	.....	.....	**$86.00**	**$86.00**	**$17.72**	**$21.37**
	90.00	*90.00*	*88.50*	*88.50*	*87.50*	*87.50*	*81.00*	*$80.50*	*$79.50*	.....	.....	.....	.....
Baltimore	**78.00**	**80.00**	**80.00**	**78.00**	**82.00**	**86.00**	**95.00**	.....	.....	160.00	150.00	18.45	21.995
	88.00	*90.00*	*93.00*	*92.00*	*94.00*	*94.00*	*100.00*	*100.00*	*100.00*	.....	.....	.....	.....
Birmingham	**87.50**	**87.50**	**87.00**	**86.00**	**87.00**	**90.00**	**110.00**	.....	.....	110.00	112.50	17.245	20.795
[1]	*92.50*	*92.50*	*92.00*	*91.00*	*92.00*	*95.00*	*114.00*	*97.00*	*98.00*	.....	.....	.....	.....
Boston	70.00[3]	72.00[3]	66.50[3]	62.50[3]	70.50[3]	74.50[3]	70.25[3]	.....	.....	.....	.....	18.195	21.995
	64.75	*64.75*	*62.75*	*63.25*	*62.75*	*62.75*	*60.50*	*59.50*	*59.50*	*59.50*	.....	.....	.....
Chicago ‡	**90.00**	**90.00**	**85.00**	**85.00**	**85.00**	**88.00**	**88.00**	.....	.....	115.00	115.00	14.555	17.555
‡	*95.00*	*95.00*	*90.00*	*90.00*	*90.00*	*93.00*	*90.00*	*90.00*	*90.00*	.....	.....	.....	.....
Cincinnati	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17.245	20.795
Cleveland k	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**105.00**	.....	.....	.....	130.00	150.00	17.615	21.265
k	*115.00*	*115.00*	*115.00*	*115.00*	*115.00*	*115.00*	*125.00*	*125.00*	*125.00*	.....	.....	.....	.....
Dallas	**59.00**	**59.00**	**56.75**	**57.75**	**59.00**	**61.50**	**61.00**	.....	.....	94.75	91.00	14.555	17.555
Denver	*93.50*	*93.50*	*97.00*	*97.00*	*96.50*	*96.50*	.....	.....	.....	.....	.....	10.285	12.435
Detroit	**90.00**	**90.00**	**87.00**	**87.00**	**87.00**	**93.00**	**100.00**	.....	.....	95.00	110.00	17.245	20.795
	98.00	*98.00*	*96.00*	*97.00*	*97.00*	*100.00*	*105.00*	*105.00*	*110.00*	.....	.....	.....	.....
Kansas City a	**86.00**	**86.00**	**84.00**	**82.75**	**83.25**	**86.00**	**105.00**	.....	.....	105.00	110.00	12.605	15.205
	88.00	*88.00*	*87.50*	*87.50*	*85.50*	*87.00*	*85.00*	*105.00*	*105.00*	.....	.....	.....	.....
Los Angeles a	*78.50*	*78.50*	*79.20*	*80.00*	*78.50*	*78.50*	*91.00*	*91.00*	*80.00*	.....	.....	9.81gh	11.86gh
Minneapolis ‡b	102.00[3]	102.00[3]	.....	.....	.....	.....	.....	.....	.....	.....	.....	13.765	16.615
‡b	*103.00*	*103.00*	*100.00*	*100.00*	*100.00*	*102.00*	*125.00*	*125.00*	*125.00*	.....	.....	.....	.....
Montreal e	69.00	70.00	64.00	68.00	70.00	75.09	.....	.....	.....	.....	.....	.....	.....
	97.00	*97.00*	*97.00*	*97.00*	*97.00*	*97.00*	*87.00*	*87.00*	*87.00*	.....	.....	.....	.....
New Orleans	**70.00**	**70.00**	**65.00**	**63.00**	**65.00**	**67.00**	**105.00**	.....	.....	**100.00**	**105.00**	14.555	17.555
	61.00	*61.00*	*58.50*	*56.50*	*58.50*	*54.50*	*60.00*	*60.00*	*90.00*	.....	.....	.....	.....
New York ‡	**Range from $82.50 to $87.50**						**105.00**	.....	.....	.....	.....	18.195	21.995
‡	.....	.....	*92.50*	*92.50*	*92.50*	*92.50*	*105.00*	*105.00*	*105.00*	.....	.....	.....	.....
Philadelphia	**110.00**	**110.00**	**110.00**	**110.00**	**110.00**	**110.00**	**110.00**	.....	.....	150.00	150.00	18.195	21.995
	120.00	*120.00*	*120.00*	*120.00*	*120.00*	*120.00*	*120.00*	*120.00*	*120.00*	.....	.....	.....	.....
Pittsburgh	**59.40**	**61.80**	**71.35**	**63.60**	**69.45**	**73.10**	**84.85**	.....	.....	130.60	141.00	17.88	21.63
	77.60	*76.70*	*74.70*	*73.90*	*73.80*	*74.35*	*91.35*	*96.85*	*96.85*	.....	.....	.....	.....
St. Louis j	**95.00**	**95.00**	**95.50**	**92.50**	**94.50**	**105.00**	**105.00**	*126.00*	*126.00*	120.00	120.00	14.555	17.555
San Francisco d	*82.50*	*82.50*	*77.50*	*77.50*	*77.50*	*77.50*	*70.00*	*70.00*	*70.00*	.....	.....	7.33g	8.83g
Seattle	*75.00a*	*75.00a*	*75.00a*	*75.00a*	*75.00a*	*75.00a*	*75.00a*	*75.00a*	*75.00a*	.....	.....	.....	.....

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf. [2] Roofers' N. C. Pine. [3] Spruce. [4] Native. [5] Western Pine, No. 3 Common. [6] Norway Pine. ‡ Delivered. *a* Yard prices. *b* Retail prices, less than CL *c* 5 M ft. or less. *d* Sales through wholesale distribution yard (F.o.b. purchaser's truck or carrier, San Francisco paid). *e* Plus sales tax. *f* Up to 18 ft. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *l* Delivered in 500 ft. lots. *k* These are retail yard prices. Lumber is no longer available on the base previously quoted. Less 2% for cash. Truck lots.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on ½", $95.15; on ¾", $104.85; price includes oiling and sealing charges. For other centers add rail freight increment from table on proper size. For resin dipped treatment, add $10.50 per M.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Jan. 16, 1946 Single or Double Thickness		EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50 lb. cases delivered in 200 lb. lots*	
	A quality	B quality		
Atlanta	76%	76%	$0.195	
Baltimore	70–10%	71–10%	.195	
Birmingham	68%	68%	.15[f]	
Boston	77%	78%	.195	
Chicago	68%	68%	.195	
Cincinnati	77–10%	77–10%	.195	
Cleveland	67–10–10%	67–10–10%	.195	
Dallas	76%	76%	.2075	
Denver	68%	68%	.20	
Detroit	77%	77%	.195	
Kansas City	68.10%	68.10%	.195	
Los Angeles	86%*d*	88%*d*	.2025	
Minneapolis	68%	68%	.19	
Montreal	40–5%*ab*	47%*ac*	.2125	
New Orleans	....	....	.205	
New York	73%	74%	.265*f*	Price of 60% Ammonia Gelatin is $0.0125 per lb. higher than 40%
Philadelphia	69%	70%	.195	
Pittsburgh	77%	77%	.1675	
St. Louis	77–10%	77–10%	.20	
San Francisco	66%	73%	.20	
Seattle	59%	60%	.2025	

a Discount from list, Sept., 1939; sales tax included, but 6% tax exemption not allowed for. *b* Single thickness. *c* Double thickness. *d* Discount from jobbers list Sept. 15, 1928. *f* In borough of Kings, Queens and Richmond, and in Manhattan sough of Canal St., add delivery charge of $6.00 per trip.

* Urban prices influenced by service charges or local storage and delivery regulations do not consistently reflect quantity prices in less congested areas.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.15	$0.175	$0.195
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.155 –.1625	.18 –.1925	.20 –.2125
Rocky Mtn. States	.155 –.1675	.18 –.1975	.20 –.2175
Pacific N. W. States	.1525–.165	.1825–.195	.2025–.215
Pacific S. W. States	.15 –.1575	.18 –.1875	.20 –.2075

PILES, TIES F. O. B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk.

Dimensions	Points	Length	By Rail — Pine*	By Rail — Fir
12-in. at butt	6-in.	30 to 50-ft.	$0.34	....
12-in.— 2-ft. from butt	6-in.	50 to 59-ft.	.35	....
12-in.— 2-ft. from butt	6-in.	60 to 69-ft.	.36	....
12-in.— 2-ft. from butt	6-in.	90 to 100-ft.	....	.57
13-in.— 3-ft. from butt	5-in.	91 to 100-ft.	....	.62
14-in.— 2-ft. from butt	6-in.	50 to 69-ft.	.41	.66
14-in.— 2-ft. from butt	6-in.	70 to 79-ft.	.43	.60
14-in.— 2-ft. from butt	5-in.	80 to 85-ft.	.54	....
14-in.— 2-ft. from butt	5-in.	85 to 89-ft.	.57	....
14-in.— 2-ft. from butt	5-in.	90 to 100-ft.	....	.6[c]

* Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

Prices f.o.b. per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak	$1.50	.....	$2.00	.....
	Pine	2.00	$3.00a	2.50	$3.00a
New York	S. L. Sap Pine	1.65	2.85	2.00	3.30
	Mixed Oak	1.80	3.05	2.50	3.60
Birmingham	Hardwood	1.00	1.60*a*	....	2.25*a*
Chicago	Red Oak	....	2.65/2.75*a*	....	3.55/3.70
Los Angeles	Douglas Fir	2.10	3.35*a*	3.00	4.80*a*
Philadelphia	Red Oak	....	2.10*ag*	....	3.25*ag*
St. Louis	White Oak	1.80	....	2.50	....
	Red Oak	....	2.40*a*	....	3.40*a*
	Sap Pine or Cypress	2.20	....	....	....
San Francisco	Douglas Fir	1.25*bet*	....	....	3.00*ca*/
Montreal	Birch or Maple	....	1.65	1.04	....

Tr.— Treated; Untr.— Untreated. *a* Creosoted. *b* 6"x8"x8'6". *c* Empty cell. *d* Zinc. *e* Green. *f* F.o.b. cars. *g* January 1943 price, none later available. *t* Out of market.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder in drums f.o.b. works, per 100 lb.	$2.75– 3.00
Chlorine cylinders, liquid, per lb. delivered	.0675
Calcium chloride, 77–80%, flaked, 100-lb. paper bag, del'd, ton	21.50–38.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	1.55
Soda ash, 58%, in paper bags, per 100 lb. dense	1.28
Sulphate of aluminum, commercial, in 100-lb. bags	1.15–1.30
Sulphate of copper, in bbl., per 100 lb.	7.10

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE PARTITION—SCORED Per M. lots of 2,000 pieces or over,			STRUCTURAL CLAY TILE—LOAD BEARING—SCORED Per M. lots of 2,000 pieces or over,			BRICK Per M. in quantity		LIME		
	3x12x12 in.	4x12x12 in.	8x12x12 in.	8x12x12 in.	10x12x12 in.	12x12x12 in.	Common backing	Straight hard	Per ton Hydrated finishing	In paper, Common hydrated	Carload lot, Pulverized, or lump
Atlanta	$112.50	$132.60	$234.60	$244.80	$273.40	$306.00	$24.00	$24.00	$19.00	$17.50	$17.50
Baltimore	110.00	116.00	208.00	225.00	290.00	320.00	23.75*k*	29.75*k*	22.50	17.50	2.75*m*
Birmingham	97.50	104.00	195.00*c*	231.00	.....	.....	19.50	21.50	20.11	17.50	.....
Boston	105.00†	112.00†	210.10†	252.09†	.....	.....	20.00*i*	20.00*i*	21.00†	.....	16.00
Chicago	92.10	98.40	185.20	.....	.....	.....	18.50	19.50	24.00	18.00	.....
Cincinnati	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cleveland	99.50	106.00	195.50	.....	.....	.....	24.00	24.00	19.65	17.15	22.15
Dallas	.....	83.00	.....	.....	.....	.....	18.00	20.00	28.00	22.00	15.00
Denver	105.25	119.00	198.25	230.00	263.50	315.35	26.50	.....	34.80*bb*	28.00*bb*	34.00*bb*
Detroit	106.80	125.10	219.30	252.90	320.20	366.30	24.50*f*	26.50*f*	24.00	22.00	22.00
Kansas City	.....	.....	.....	.....	.....	.....	17.50	18.50	34.00	30.00	30.00
Los Angeles	*r*	*r*	*r*	*r*	*r*	*r*	18.00	20.50	21.80	18.80	22.80
Minneapolis	136.50*cc*	151.50*cc*	270.40*cc*	151.50*ucc*	.....	.....	21.00*e*	.....	30.00*bb*	23.00*bb*	30.00*bb*
Montreal	92.50*a*	98.50*a*	196.25*a*	151.50*a*	.....	294.40*a*	22.10	31.80	12.50*u*	14.00*u*	8.00*u*
New Orleans	.....	.....	.....	.....	.....	.....	22.50	.....	21.20	18.00	14.10
New York	103.90	110.80	152.35*c*	166.70*hn*	.....	.....	25.50	.....	30.00	24.00	.....
Philadelphia	112.10	119.60	224.20	269.10	321.20	405.10	24.75	27.75	25.65	19.10	19.00
Pittsburgh	98.50	105.80	181.85	217.30	265.85	303.10	24.00	26.00*y*	19.40*cc*	16.90*cc*	2.85*m*
St. Louis	101.15	112.95	209.60	220.50	237.60	304.00	26.00*s*	25.00*s*	.65*saa*	.50*saa*	.75*s*
San Francisco	124.00	139.50	186.00*dd*	139.50*t*	.....	.....	25.00	.....	22.10	22.10	2.21*m*
Seattle	137.00	147.00	.....	147.00*ccw*	.....	.....	28.50*k*	33.50*k*	27.95*s*	27.95*s*	3.28*m*

† F.o.b. *a* Smooth. *b* Carload lots delivered to job. *c* 6 x 12 x 12 in.-3 cell. *f* Includes $3.50 per M. for truck delivery. *h* F.o.b. Perth Amboy, N. J. *i* F.o.b. Warehouse only. *k* $1.00 discount. *m* Per bbl., 180 lb. *n* 7¾ x 7¾ x 12. Speed tile. *o* Per bbl., 200 lb. *r* Not used because of earthquake danger. *s* 2% discount for cash. *t* 5½ x 8 x 11½. *u* 8% sales tax included. *v* Sand lime. *w* 5 x 8 x 12. *y* Stacked. *z* Pebble lime price per 80 lb. sack. *aa* Price per sack. Lime recently not sold per ton. *bb* LCL delivered. *cc* Truck delivery. *dd* 6 x 12 x 12.

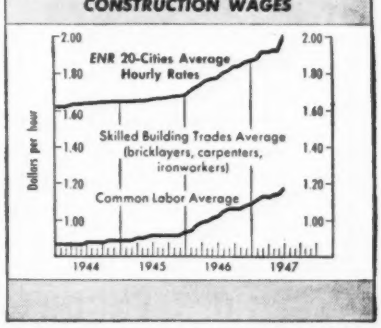
PAINT, ROOFING—F.O.B. CARLOAD LOTS

	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl. Dry *a*	WHITE LEAD Per 100 lb. in 100 lb. cases In oil *w*	READY-MIXED PAINT Graphite *b*	Per gal., drums Aluminum *c*	Ferric Oxide *d*	ROOFING SUPPLIES Carload lots f.o.b. factory Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 360 lb. bbl. per ton
Atlanta	$18.75	$27.375	$1.75	$2.70	$1.65	$2.06	$2.06	$2.06	$1.00	$36.00
Baltimore	18.50	27.50	2.25	3.50	2.75	2.50	3.00	3.00	.50	30.00
Birmingham	18.75	27.375	4.40	4.52	....	2.84	2.70	2.70	.40	34.50
Boston	18.50	27.00	1.75	2.50	2.31	2.00‡*h*	3.30‡*ut*	3.30‡*ut*	.25‡	21.00‡
Chicago	18.50	27.00	....	....	....	1.75‡*h*	2.55‡*h*	2.55‡*h*	....	29.00‡
Cincinnati	18.50	27.00	....	....	....	....	....	....	....	.....
Cleveland	18.50	27.00	3.00	3.00	3.00	2.21	2.26*o*	2.26*o*	.30*y*	33.00
Dallas	18.50	27.00	....	4.05	....	2.75*h*	2.90*h*	3.15*h*	.80	49.00
Denver	18.50	27.50	2.75	4.35	2.50	2.625	2.625*h*	2.625*h*	.365	32.40
Detroit	18.50	27.00	1.75	3.00	1.60	2.25	2.25	2.25	.50	23.00
Kansas City	18.50	27.125	3.30*g*	3.55*g*	3.16*g*	3.00	3.25	3.25	.67	.....
Los Angeles	18.75	27.50	2.80	4.00	3.50	2.60	1.90	....	.60	.....
Minneapolis	18.50	23.88	....	....	....	2.10*i*	2.15*hi*	2.15*hi*	.37	26.00
Montreal	.....	.....	2.90*p*	4.20*p*	3.62*p*	2.85	2.58*t*	2.07*t*	.68	1.85*k*
New York	18.50	27.00	3.45	....	3.45	2.10	2.15*o*	2.15*o*	.30*z*	26.00
Philadelphia	18.50	27.00	1.75/2.00	2.40	1.70	2.54	2.94	2.94	.37	26.00
Pittsburgh	18.50	27.00	1.98	2.40	1.75	2.32	2.37*h*	2.37*h*	.37	28.00
St. Louis	18.50	27.00	2.28*s*	2.89*s*	1.96*s*	2.40	2.26	2.26	.35	27.00
San Francisco	18.75	27.25	1.80	2.75*n*	1.35	1.96*x*	....	....	.52	.....
Seattle	18.75	27.50	3.15	3.15	....	2.75	2.80*h*	....	.41	35.00*j*

‡ Delivered. Note: Red lead in oil 50c higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *f* Distributors' price to contractors. *g* 55 gal. can. *h* Per roll, 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per cwt. *n* May. 1941 price. *o* 60-lb. roll. *p* Plus 8% sales tax. *s* December, 1942 price. *t* Federal tax included. *u* 90-lb. roll. *v* Truck delivery. *w* Price to large paint contractors is $1.25 less. *x* Mineral surfaced. *y* 55-gallon container. *z* Drums.

SKILLED AND COMMON WAGE RATES—PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor Building	Common Labor Heavy Const.
Atlanta	$2.00	$1.50	$1.75	$1.75	$2.00	$0.75	$0.85
Baltimore	2.25*b*	1.775	2.15	1.625/2.00	1.90	1.10	1.10
Birmingham	2.00	1.625	1.75	1.50/1.75	1.875	.75	.85
Boston	2.15	1.90	1.95	2.25	2.00	1.40	1.40
Chicago	2.20	2.15	2.20	2.15	2.225	1.50	1.50
Cincinnati	.....	.....	.....	.....	.....	.....	.....
Cleveland	2.25	2.125	2.25	1.875/2.125	2.125	1.275	1.375
Dallas	2.00	1.625	1.75	1.75	1.875	.90	.90/1.25
Denver	2.25*b*	1.875	1.70*b*	1.875*b*	2.25	1.275	1.35
Detroit	2.00	1.825	2.00	1.85/2.00	2.10	1.275	1.275
Kansas City	2.00	1.75	1.875	1.875	2.00	1.175	.90
Los Angeles	2.25	1.90	2.25	2.00	2.50	1.25	1.25
Minneapolis	2.075	1.80	2.00	1.85	2.25	1.30	1.30
New Orleans	1.9375	1.50	1.875	1.75	1.875	.80	.80
New York	2.75*b*	2.50*b*	2.50	2.50*b*	2.50*b*	1.50	1.50
Philadelphia	2.375	2.00	2.15/2.25	2.50	2.50	1.10	1.10
Pittsburgh	2.15	2.00	2.00	2.05	2.00	1.15	1.15
St. Louis	2.25	1.95	2.00	2.20	2.25	1.35	1.35
San Francisco	2.25	1.75	2.00	1.85	2.25	1.25	1.25
Seattle	2.105	1.805	1.93	1.95	2.105	1.405	1.30
Montreal*	1.17	1.06	1.11	1.00	1.17	.73	.73



b 7 hr. day. * Cost of living bonus now included in basic wage.

ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $2.013.

ENR Common Average: $1.189.

UNITED STATES RUBBER COMPANY

SERVING THROUGH SCIENCE

THE BOSS had completely equipped all compressor lines with new hose on the last job. And now here was his foreman yelling for more hose!

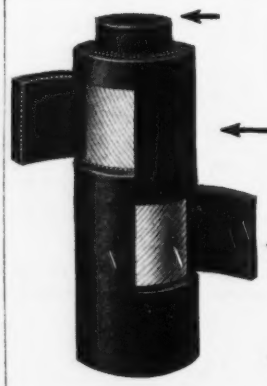
But the foreman was right.

The compressors were "spitting" oil. The lining of the hose had swollen and failed because of the destructive action of the oil vapors.

So the Boss did a little investigating and he discovered that U. S. Peerless Compressor Hose is not hurt by hot oil. Its unique bruise-resistant cord carcass can take plenty of smashing and battering . . . not on just one job, but a great many.

U. S. Royal Cord Air and U. S. Peerless Compressor Hose—both with cord carcass—are available at your equipment distributor or the nearest branch of United States Rubber Company.

The Unique U. S. ROYAL CORD CONSTRUCTION



Rubber tube compounded for air conditions.

All cords in all pressure-resistant plies laid parallel (non-crossing)... each in a cushion of rubber for protection against bruising. No shearing is possible under expansion, contraction, and flexing.

Tough, thick, wear-resistant cover.

IF HOT OIL VAPORS ARE PRESENT,

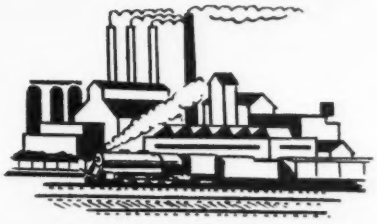
use Peerless Compressor Hose. Same cord construction with special synthetic rubber lining oil cannot ruin.

U. S. ENGINEERED RUBBER PRODUCTS FOR THE CONTRACTOR

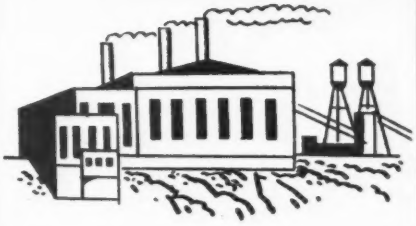
Air, Water, Steam, Suction Hose · Belts · Packings · Tape

A BRIDGE

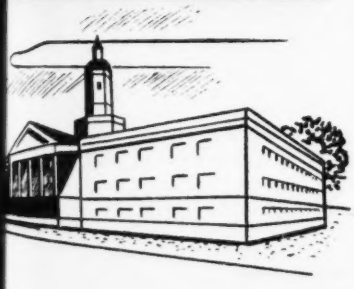
A FACTORY



A POWER PLANT



A SCHOOL



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AN OFFICE BLDG.

then look to FORT PITT BRIDGE

a modern organization of engineers, fabricators and erectors . . . with old-fashioned ideas about prompt deliveries—as promised, and with precision accuracy

STEEL PERMITS STREAMLINING CONSTRUCTION WITH SAFETY, ENDURANCE AND ECONOMY

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Member American Institute of Steel Construction

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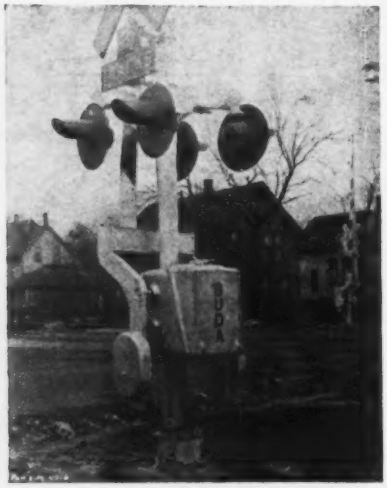
New Aids to the Constructor

MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

SCREENING AND CRUSHING PLANTS—Hammermill units have detachable 30-in. feeder and 6x6-ft. charging hopper. Feed conveyor is 30-in.x 30-ft. channel frame type. Truck is 8 ft. wide, with 42-ft. traveling length and 12¼-ft. traveling height. Weight is 48,300 lb. complete with conveyors, brakes, charging hopper and feeder but less power unit. Company also announces new 10,000-lb. portable power unit and 7,000-lb. portable bin.—*Iowa Mfg. Co., Cedar Rapids, Iowa.*



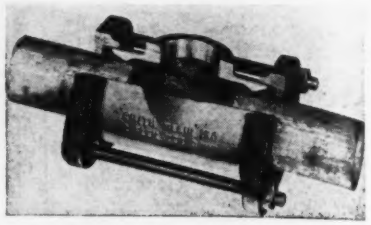
CROSSING GATE—An entirely new crossing gate conforms to American Association of Railroads and state highway department requirements governing visibility, construction and operation. Model 71 Safety Gate is a weatherproof, fully automatic, post type gate —so-called because it can be conveniently mounted on any standard 4, 5, 6 in. signal or flasher post without requiring specially constructed foundation or mechanism.—*The Buda Co., Harvey, Ill.*

COMPRESSORS—"Unitair" compressors are available in nine sizes with power requirements ranging from 15 to 100 hp. and piston displacements from 81 to 590 cu. ft. per min. at 100 lb. discharge pressure psi. based on 60 cycle motor speeds. Because of compact construction and smooth, vibration-free operation, Unitair requires but a small foundation; it is completely air-cooled. The three standard electric drives include built-in motor, direct-connected motor and V-belt drive, use with gasoline or diesel engines is also possible.—*Sullivan Division, Joy Manufacturing Co., Oliver Bldg., Pittsburgh 22, Pa.*

AIR VALVES—A new line of hand-operated air valves for crane control and similar purposes, makes use of the balanced piston principle.

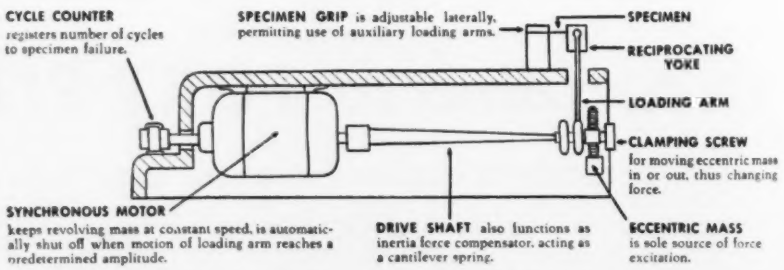
Pistons are held in position by air pressure. Linkage or mechanical connections between pistons and operating lever are eliminated. This reduces the number of moving parts and contributes to ease of maintenance as it is never necessary to disconnect pistons from operating lever. Made of cast alloy aluminum, this 3-position lever, 4-way valve is completely streamlined. It is designed and manufactured for a 175 lb. maximum working pressure, and all inner parts are made of stainless steel and bronze.—*Lindberg Engineering Co., 2444 W. Hubbard St., Chicago 12, Ill.*

ELECTRODE—Airco No. 375 electrode for machinable welds on cast iron has a high nickel core wire and a heavy extruded coating that has a possible application wherever an electrode is used on cast iron. Ordinarily preheating is not necessary. Because of its high nickel content, the electrode flows well and the resultant deposit is sound. The weld and fusion zone is soft and easy to machine.—*Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.*



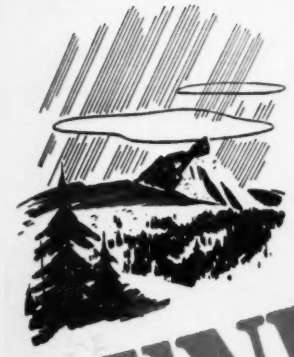
TEE COUPLING—Flexible tee coupling connects laterals to existing pipelines without need for field threading in the trench and does away with flexible couplings, nipples, tees and unions. Flexible tee is available for 2 in. cast iron, standard and O.D. pipe and for other sizes to as small as ¾ in. In each, outlet is same nominal size as pipe run but has standard threads which permit use of bushing where needed.—*Smith-Blair Co., South San Francisco, Calif.*

LOW HORSEPOWER ENGINE — A light weight 2 hp. engine features a patented easily replaceable head embodying the valve mechanism and combustion chamber. The 4-cycle valve-in-head engine is so constructed that repair work can be performed without shop equipment. An integrally cast crank-case housing and aluminum cyl-


CYCLE COUNTER
registers number of cycles to specimen failure.
SPECIMEN GRIP is adjustable laterally, permitting use of auxiliary loading arms.
SPECIMEN
RECIPROCATING YOKE
LOADING ARM
CLAMPING SCREW
for moving eccentric mass in or out, thus changing force.
SYNCHRONOUS MOTOR
keeps revolving mass at constant speed, is automatically shut off when motion of loading arm reaches a predetermined amplitude.
DRIVE SHAFT also functions as inertia force compensator, acting as a cantilever spring.
ECCENTRIC MASS
is sole source of force excitation.

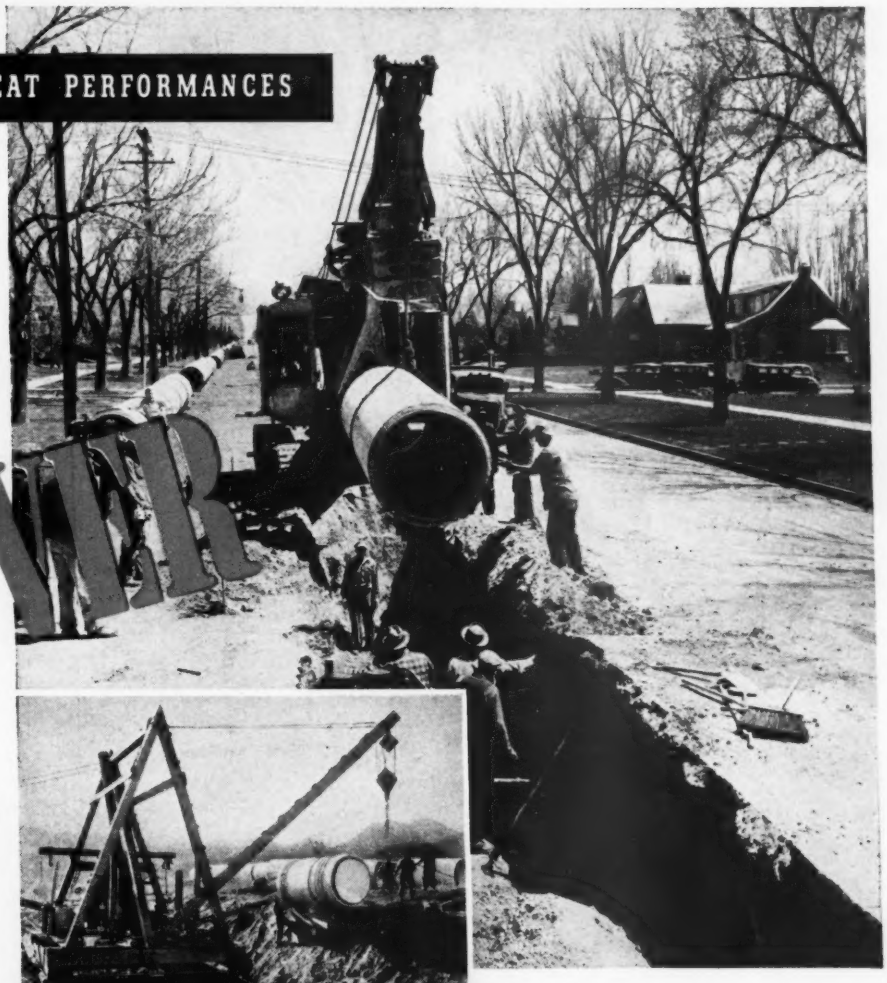
FATIGUE TESTING MACHINE — Sonntag Model SF-2 machine with the "constant-force" loading feature, affords flexure fatigue tests on sheet stock of any material—metal, plastic, wood—and requires no attention during test. Because of its comparatively small size, 15x12x32 in., machine can be placed in cabinet during test so that temperature and humidity can be controlled. It weighs 115 lb., has alternating force capacity of 20 lb. and speed of 1,800 cycles per minute with total travel of loading yoke of one inch per cycle.—*Baldwin Locomotive Works, Philadelphia 42, Pa.*

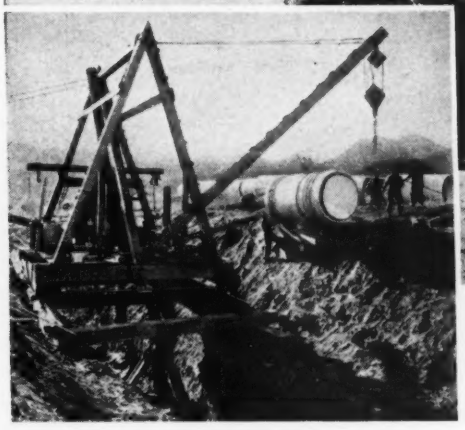
LOCK JOINT REPEAT PERFORMANCES



DENVER

13 JOBS SINCE 1920





1940—Above: Installing 48" pipe through center of street in residential area.

1921—Left: Installing pipe with old type wooden derrick astride ditch.

To meet the enormous demands of increasing population and expanding industry, Denver has steadily extended its water supply system. Since 1920 Lock Joint Pipe Company has been awarded 13 major water works contracts totalling approximately 90 miles of Reinforced Concrete Pressure Pipe. Such repeat orders, not only for Denver but for many other key cities, are convincing evidence of the incomparable quality of Lock Joint Reinforced Concrete Pressure Pipe.

The life expectancy of Lock Joint Reinforced Concrete Pressure Pipe has been rated at better than 100 years. During this life span Lock Joint Pipe will retain its characteristic high qualities: immense structural strength, permanent high carrying capacity, low maintenance cost and unfailing service.

SCOPE OF SERVICES—*Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.*

For future projects, large or small, specify Lock Joint Pipe.

A Hazen-Williams Hydraulic Slide Rule will gladly be sent upon request with our compliments.

LOCK JOINT PIPE COMPANY

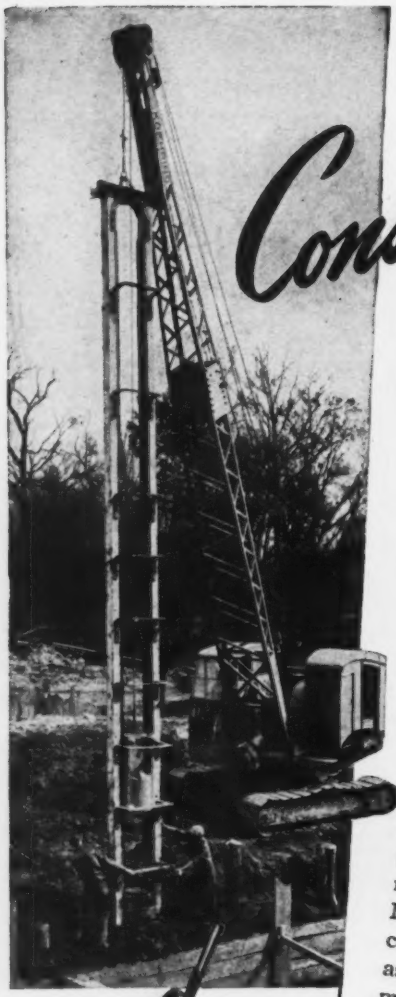
Established 1905

P. O. Box 269, East Orange, N. J.

Pressure Pipe Plant: Wharton, N. J. • Sewer Plant: Kenilworth, N. J.

BRANCH OFFICES: Denver, Colo. • Chicago, Ill. Kansas City, Mo. • Rock Island, Ill. • Joplin, Mo. Valley Park, Mo. • Cleveland, Ohio • Hartford, Conn. Navarre, Ohio

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE



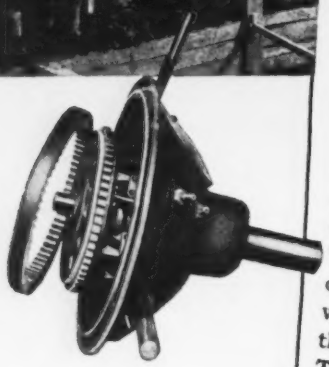
Conservatively Rated

Conservative rating is an assurance of *top* performance and *long* wear-life in your Twin Disc Power Take-off. All parts . . . such as clutches, shafts, bearings . . . are designed and built with liberal margins of safety . . . have given superior performance through long service on the toughest construction jobs.

The Twin Disc Power Take-off is designed for application to all types of internal combustion engines with flywheel housing dimensions of from No. 6 SAE to No. 00 SAE. The unit consists of a complete Clutch Power Take-off assembly with shafts and bearings mounted in a rigid cast iron housing.

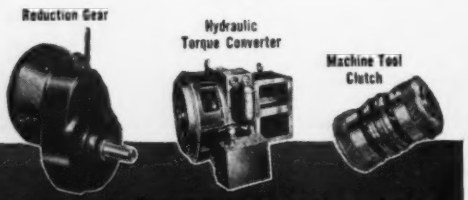
Sizes range from 6.5″ to 24″ in single-plate construction and from 11″ to 24″ in double-plate, with capacities up to 650 hp. Write the Twin Disc Clutch Company, Racine, Wisc., for Bulletin No. 129B, which gives more information on the Twin Disc Power Take-off.

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).



Equipped with a Twin Disc Power Take-off, this Koehring Model 304 Crane is operating a pile driver.

Twin Disc Power Take-off . . . capacities up to 650 hp.



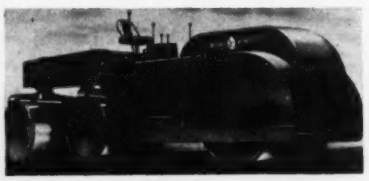
TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES
REG. U.S. PAT. OFF.

SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918

inder block save weight, enable the engine to deliver twice as much power per pound of weight as conventional models. The 2¼ in. flatheaded aluminum piston has a 2¼ in. stroke.—*Scott Engine Co., 1 North LaSalle St., Chicago 1, Ill.*

AUTO RAILER—The Evans Auto-Railer, with Quick Way ¼ cu. yd. truck shovel mounted on an International 147-in. wheelbase Model KB-5 chassis, is a dual purpose vehicle designed for operation on railroad tracks and highways. The full-revolving truck shovel can be converted to crane or trench hoe and is powered by an International Harvester 4-cylinder engine. The Auto-Railer can be run over the highway to the railroad crossing nearest the point of work and then run on the track.—*Motor Truck Division—International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.*

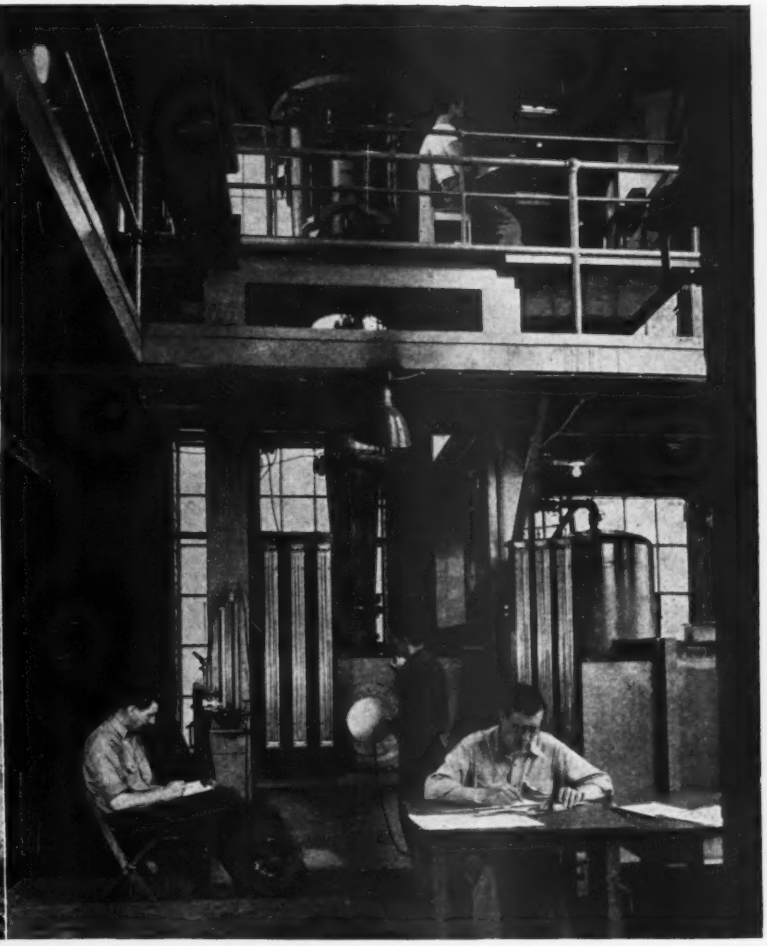
2, 4-D IN LIQUID FORM—Knox-Out Weeds Liquid, a new liquid 2,4-D compound, mixed with water, will effectively treat planted surfaces. This liquid has proved effective as a selective weed killer, killing most broad leafed weeds but not harming most types of lawn or field grasses. When applied as a coarse spray in water, it is absorbed by broad leafed weeds and taken into their root systems, killing the plants in from one week to a month.—*Pennsylvania Salt Manufacturing Co., Philadelphia, Pa.*



3-AXLE TANDEM—A new 3-axle tandem roller, KX-25, incorporates in one roller many important features. It will have an approximate metal weight

No GUESSWORK-

Each problem is worked out in advance scientifically



The SMITH *Laboratory-*

PROVING everything in advance! This in large measure accounts for our supremacy in the field of Hydraulics. We very early recognized that the designing of modern, high efficiency turbines, pumps and adjustable blade ship's propellers requires precise scientific knowledge. Hence we established our own Hydraulic Testing Laboratory where the answers to problems are worked out in homologous models before production starts -- another advantage of placing your hydraulic problems in our hands!

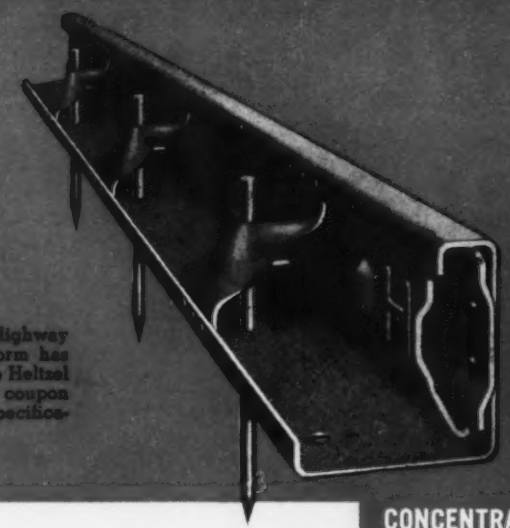
If It's Hydraulics- Put It Up to Us!

S. MORGAN SMITH Co.

YORK, PENNA. U.S.A.

build better with

HELTZEL STEEL FORMS



Heavy Duty Highway and Airport Form has many exclusive Heltzel features. Send coupon for complete specifications.

HIGHWAYS The heavy duty highway and airport forms have several exclusive Heltzel features . . . 2½" tread . . . up-turned base flange — 50% additional strength . . . extended lock joint guide . . . hot pressed ¼" lock joint — V type eliminates clogging . . . non-clogging single wedge stake pockets that are not affected by vibration. The base flange is also drilled for auxiliary stakes or bolting on risers. The $\frac{7}{32}$" form is recommended for all construction up to 20' widths. The ¼" form is recommended for construction over 20' in width. Both forms meet all highway specifications.

CURBS

CURB AND GUTTER

SIDEWALK

AIRPORT Heltzel also has steel forms for curb, combined curb and gutter, sidewalk, rigid radius and flexible radius.

CONCENTRATED *Engineering* IN CONCRETE CONSTRUCTION

Heltzel BUILDS IT BETTER

- BINS, Portable and Stationary
- CEMENT BINS, Portable and Stationary
- CENTRAL MIXING PLANTS
- BATCHERS (for batch trucks or truck mixers with automatic dial or beam scale)
- BITUMINOUS PAVING FORMS
- ROAD FORMS (with lip curb and integral curb attachments)
- CURB FORMS
- CURB AND GUTTER FORMS
- SIDEWALK FORMS
- SEWER AND TUNNEL FORMS
- CONCRETE BUCKETS
- SUBGRADE TESTERS
- SUBGRADE PLANERS
- TOOL BOXES
- FINISHING TOOLS FOR CONCRETE ROADS

Heltzel Steel Form & Iron Company, Warren, Ohio

SEND ME STEEL FORM CATALOGS:

[ ] B-19 Steel Highway and Airport Forms

[ ] B-19A Steel Dual Duty Airport Forms

[ ] A-20 Steel Forms for Curbs or Curb and Gutters or Sidewalks.

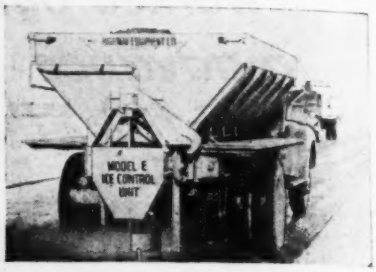
Name_____

Address_____

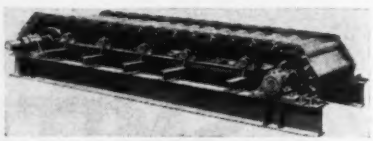
(Type of construction usually engaged in)

HELTZEL STEEL FORM & IRON CO. WARREN, OHIO · U. S. A.

of 12 tons and a ballasted weight of 18 tons. The wheel base will be shortened to give added maneuverability, while the rolls will be widened. —*Buffalo Springfield Roller Co., Springfield, Ohio.*



HIGHWAY SPREADER — Featuring speed, safety and versatility, a new all-purpose spreader is designed to distribute a protective coat of sand or cinders quickly. The distributor disc casts material low, ahead of rear wheels of truck. Thickness and width of spread are easily controlled from the driver's seat to cover either 2- or 4-lane highway. Built in four lengths to mount on any truck chassis, Highway Model "E" is driven by power take-off from truck transmission. This unit can also be used for dust control with calcium chloride in summer, and for applying seal coats on oil.—*Highway Equipment Co., Inc., Cedar Rapids, Iowa.*



MANGANESE STEEL FEEDER—The Pioneer-Oro manganese feeder combines great strength and dependable service. Designed especially for tough jobs, this feeder is constructed to handle efficiently, and at high capacities, large tonnages of abrasive or non-abrasive materials, large lumps of broken stone at quarries and excavation projects, and slag formations at steel plants. It is made in pan widths from 36 up to 48 in. and in lengths from 6 ft. 3 in. to 16 ft. 9 in. (center to center of shafts).—*Pioneer Engineering Works, Inc., 1515 Central Ave., Minneapolis 13, Minn.*

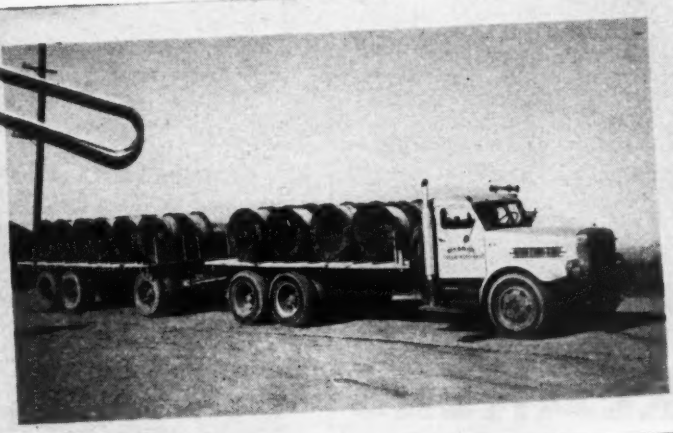
CRANE DOOR-CLOSING ARMS—Positive power closing of large and small swing type crane doors is accomplished by the use of powered closing arms. Accompanying this new development, a series of mechanical and

LUBE MEMO

1½rd million miles without major overhaul!

This Warren Transportation Co. truck ran 320,000 miles on RPM DELO Oil without major overhaul. Fluid Drive Sterling–6 cyl. Cummins Engine

Guy Warren writes all 20 of his heavy trucks give fine performance on RPM DELO Diesel Engine Lubricating Oil They travel 1,250,000 mi. yearly.



Av. gross load 14,000 lbs.

How does RPM DELO OIL Cut wear?
It's compounded to:
1. Stick to hot spots other oils leave bare
2. Stop bearing corrosion
3. Prevent engine deposits
4. Guard against sludge
5. Eliminate foaming

DIESEL ENGINE RPM DELO LUBRICATING OIL

NOTE: Thank Guy Warren, Hayward, Calif. for tip on RPM DELO OIL

STANDARD OF CALIFORNIA • San Francisco, Calif.
THE CALIFORNIA COMPANY • Denver, Colo.
STANDARD OIL COMPANY OF TEXAS • El Paso, Texas
THE CALIFORNIA OIL COMPANY • New York

A ONE-MAN CREW
THAT WILL **SAVE MONEY** FOR YOU

SYNTRON
100%
Self-Contained
Gasoline Hammer

PAVING BREAKERS

Busting concrete—**Digging** clay and shale
Cutting asphalt — **Tamping** backfill and a host of other jobs.

Write for illustrated folder

SYNTRON CO., 328 Lexington, Homer City, Pa.

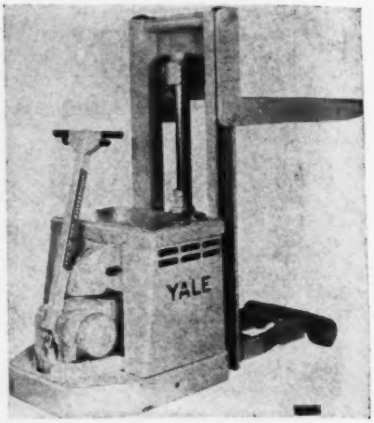
MacArthur

37 YEARS INSTALLING PILES
OF EVERY TYPE

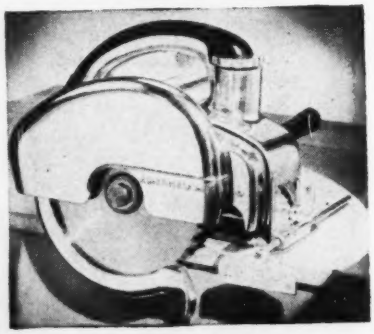
CAST-IN-PLACE CONCRETE COMPOSITE
STEEL SECTIONAL PIPE TIMBER
SOIL AND ROCK BORINGS

MacARTHUR CONCRETE PILE CORPORATION
18 EAST 48th STREET, NEW YORK 17, N. Y.
BOSTON • CINCINNATI • NEW ORLEANS

electrical interlocks insure proper operation of the door. The lower door slides completely to the right where it engages a combination interlock, unlatching the upper door which is then swung up into the open position by means of six heavy duty cables. In closing all operations are automatically reversed.—*Fleming Steel Co., New Castle, Pa.*



ELECTRIC HAND TRUCK—Industry acceptance of the "work-saver" type of fully-powered hand truck has brought about a new variation which permits the load to be lifted to considerable heights from the floor for purposes of stacking and picking up from elevated docks, racks or tailgates. Lifting capacity is 4,000 lbs., height of lift 7 in. to 66 in. or 11 in. to 70 in.—*The Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia 24, Pa.*



PORTABLE POWER SAW—New portable electric saw has been engineered to save job time, perform with greater ease and less fatigue for operator, and handle numerous jobs in construction, shipping and maintenance where wood, mortar, roofing, wall board and other materials are to be cut. Special General Electric motor develops 1½ hp. with direct power gear drive to 8-in. blade. This provides a 50 percent greater maximum horsepower for 8-in. saw without increase in weight. Blade

POISON IVY MENACE—and How One Foreman Licked It

Poison ivy rash took valuable workers off the job every time they cleared the ground of trees and underbrush . . . lost time increased. Then a new foreman started to train the workers. He taught them how to recognize poison ivy, what protective clothing to wear, how to uproot and burn the plants, what to do if they touched the plant. That ended the poison ivy menace for this crew.

Every foreman should know how to combat poison ivy. If you'd like an authoritative booklet on Poison Ivy, Oak, Sumac and Snakes, we'll be glad to furnish you with free copies for distribution to your foremen. This is one of THE GUIDE LINES, a series of booklets furnished to Liberty Mutual policyholders as one of the many regular services in our construction insurance program.

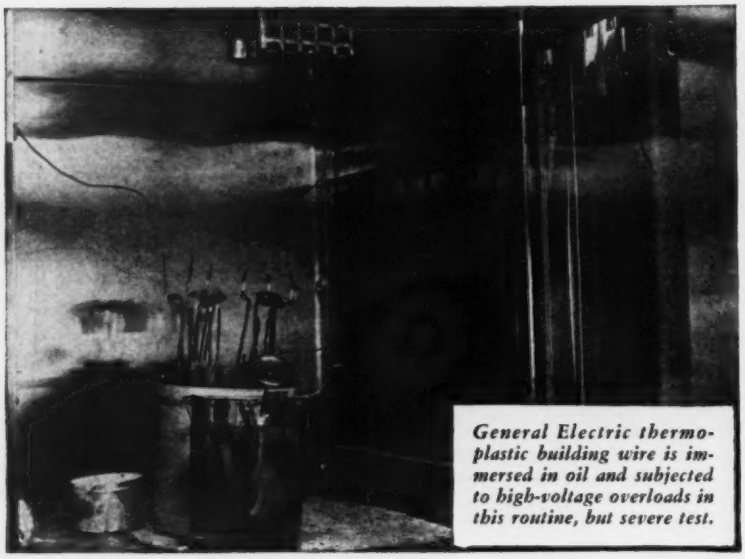
As the leading writer of Construction Insurance in America, Liberty Mutual has the experience to help you prevent construction accidents, settle claims fairly and promptly, and fully protect you on every job. And no matter where you go, our 105 Branch Offices are prepared to give you the same high grade of service at all times. That's why leading contractors everywhere insure with Liberty Mutual.

Would you like more information on Liberty Mutual's specialized construction service? Drop us a line today.*

*FREE TO CONTRACTORS... Here's a booklet your foremen should have. Factual, illustrated, full of information on how to prevent losses caused by poison ivy and the other hazards of rough grading. For your FREE copies, write to: Construction Bureau, Liberty Mutual Insurance Company, 175 Berkeley Street, Boston 17, Massachusetts.

LIBERTY MUTUAL
INSURANCE COMPANY
HOME OFFICE: BOSTON
The leading writer of Construction Insurance in America

STANDS UP TO OIL *unnaturally*



General Electric thermoplastic building wire is immersed in oil and subjected to high-voltage overloads in this routine, but severe test.

Sooner or later, oil penetrates and softens most insulations of natural organic origin. But General Electric's thermoplastic building wire has the *un*natural ability to resist oil year after year with no weakening in its outer line of defense. Chemically, it simply *ignores* the oil, even when coated with it, or submerged in it.

Users of General Electric Types T and TW no longer fear the conditions that may subject building wire to oil in installation or service . . . greasy hands, leaking pipes, running wires to process equipment. And they're equally unconcerned about moisture and most chemical fumes or vapors.

What's more, this *un*naturally long-lived insulation saves time for the installer, too. It pulls easily, strips cleanly, and is highly abrasion-resistant. No wonder it has been accepted so rapidly as a permanent advance!

Thermoplastic
First . . . and foremost
Type T Building Wire

Because General Electric pioneered thermoplastic, you get the benefit of extra years of improvement when you add "G.E." to your specifications for Types T and TW building wires. To learn about their long-term savings, write to Section W55-632, Appliance and Merchandise Department, General Electric Company, Bridgeport 2, Conn.

*Trade-Mark Reg. U. S. Pat. Off.

GENERAL ELECTRIC

AROUND THE CIRCUIT with your

Merchandise Distributor

ANOTHER THERMOPLASTIC-INSULATED WIRE that has excellent electrical and

physical characteristics is General Electric *fixture wire*, Types TF & TFF. Use them in wiring lighting fixtures when you want small diameter, single-conductor wires that are easy to handle in every way. They can be identified easily by the bright, permanent color coding.

NOT ONE — BUT THREE TYPES of Flamenol* portable cords are made by General Electric for use on portable tools and appliances, ranging from electric fans to powerful grinding machines. Select heavy-duty, medium-duty, or rip-cord to fit your needs. All are available in a variety of sizes and strandings.

THIS OLD MAN IS SPRYER THAN EVER after fifty years of useful service. We're talking about good old BX* armored cable, which is fifty years old this year. A product has to be good to stick that long — one of the reasons that so many General Electric products today are still being sold after many years on the market.

YOU'VE GOT TO PUT POWER IN TO GET POWER OUT — so don't forget General Electric's service entrance and service drop cables and fittings in planning industrial or residential wiring. They are backed by the electrical and

manufacturing experience of the leading name in wires and cables.

"That new Rex Tilter sure is a money-maker!"

You'll mix more yards per day . . . concrete or mortar . . . make more profit per job with a new Rex Tilting Mixer. It's the greatest money-maker you've ever seen.

Note these time-saving, job-speeding features. Perfect balance with low center of gravity and 62-inch wheel spread for fast, safe towing. Easy rolling pneumatic-tired wheels mounted with Timken bearings plus accurate balance make it easy for one man to spot the mixer. Four-point suspension assures stability while mixing . . . no "teetering" or shifting. Two-position loading . . . you can bring the barrow straight to the drum, head-on or sideways without interference. Fast, thorough mixing action and convenient controls. Long-lasting, all-welded, pressed steel drum bowl. Dependable, economical power plant. Complete lubrication from the outside.

Add them up, you'll see why you get more of everything . . . service, long life, dependability and profit . . . with the new Rex 3½S Tilting Mixer. It conforms with A.G.C. Standards—for your protection.

See them at your local Rex Distributor or write Chain Belt Company, 1633 West Bruce Street, Milwaukee 4, Wisconsin, for all the facts.

CHAIN BELT COMPANY *of MILWAUKEE*

REX

CONSTRUCTION MACHINERY

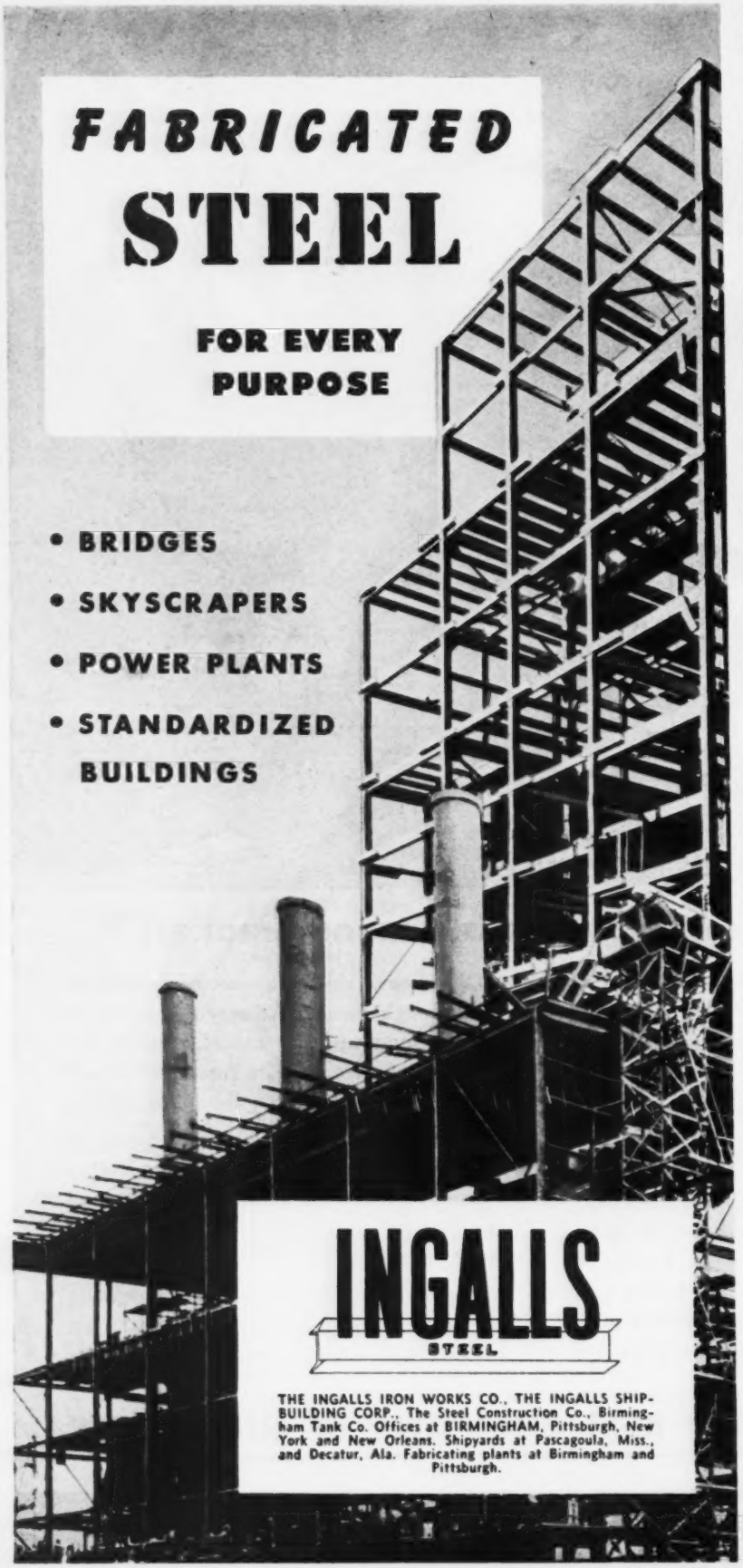
PUMPS

PAVERS

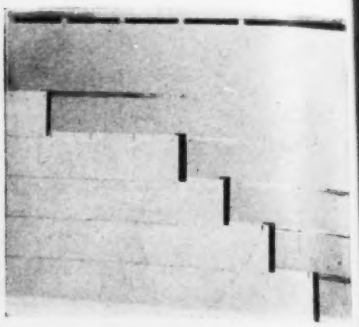
PUMPCRETES

MOTO-MIXERS

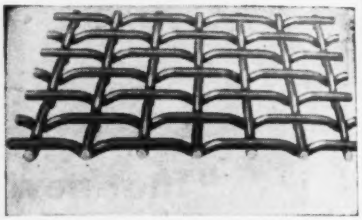
MIXERS


FABRICATED
STEEL
FOR EVERY PURPOSE
• BRIDGES
• SKYSCRAPERS
• POWER PLANTS
• STANDARDIZED BUILDINGS
INGALLS
STEEL
THE INGALLS IRON WORKS CO., THE INGALLS SHIPBUILDING CORP., The Steel Construction Co., Birmingham Tank Co. Offices at BIRMINGHAM, Pittsburgh, New York and New Orleans. Shipyards at Pascagoula, Miss., and Decatur, Ala. Fabricating plants at Birmingham and Pittsburgh.

will make 2⅞-in. straight cut and will saw 2-in. plank with a 45-deg. angle cut.—*American Floor Surfacing Machine Co., Toledo, Ohio.*



SIMPLE HANGERS—Known as Lox-On, these hangers consist of 26-gage galvanized clips and permit fastening cement-asbestos shingles to non-wood siding without nailing. Strips are nailed in horizontal position, two strips holding row of shingles at top and bottom. Clips, snapping over strips nailed in place in advance, hold top of one row of shingles and bottom of row next above.—*Nugent Roofing & Supply Co., 15 N.W. Riverside Dr., Evansville, Ind.*



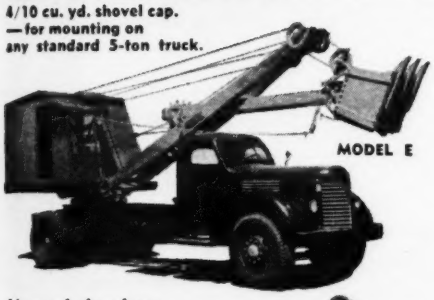
AGGREGATE WIRE SCREEN—Roe-Flat is designed to provide maximum metal surface exposed to abrasive wear usually encountered where this type of screen is used. Its flat surface evenly distributes wear, increasing screen life up to 90 percent above conventional type screens, and permits even, smooth flow across screening surface. Its smooth top practically eliminates spreading of wires and breaks usually caused by backing screens with uneven surfaces. —*John A. Roebling's Sons Co., Trenton 2, N. J.*

PERCUSSION BITS—New bit has chisel type design, hard wear-resistant Kennametal cutting edge and is driven by pneumatic percussion drilling machines.

It will withstand impact of air hammers using air pressures of 80 to 120 psi. They are being manufactured in sizes of 1⅜ and 1⅝ in.—*Kennametal, Inc., Latrobe, Pa.*

CONVERTIBLE, PROFIT-MAKING "QUICK-WAY"* TRUCK SHOVELS

4/10 cu. yd. shovel cap.
—for mounting on
any standard 5-ton truck.



MODEL E

¼ cu. yd. shovel cap.
—for mounting on any
standard 1½-ton truck.

MODEL J

*REG. U. S. PATENT OFFICE

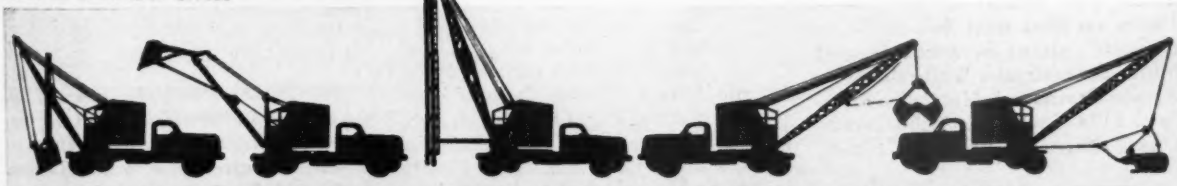
One day you want a power shovel, the next it may be a dragline, clamshell, crane, pile driver or trench-hoe. Whatever the job calls for, you can convert a **"QUICK-WAY"** from one to another in *minutes*, not hours. Balanced design for truck mounting guarantees equally high performance for all of these uses—and when you move to the next job you can travel at the *truck's top speed*.

Interchangeability of parts, simplicity, fast operation, easy adjustment and repair, low maintenance, are still more reasons why a **"QUICK-WAY"** always pays off.

Materials and skilled labor costs are now at the all-time high. Yet **"QUICK-WAY"** Truck Shovels are priced only 10% above 1941 —3½% below the old OPA ceiling. Savings realized thru stepped-up production lines have made it possible to keep **"QUICK-WAY"** prices *down*.

Regardless of what larger equipment you own, you need **"QUICK-WAY"** Truck Shovels too. They're money makers!

Service available from our Distributors, strategically located throughout U.S. and worldwide.



"QUICK-WAY" TRUCK SHOVEL CO.

DENVER, COLORADO

First to build power shovels for truck mounting; still the leader after 28 years

A high strength to weight ratio($\frac{S}{W}$) is not only good engineering but has special advantages in tunneling work. ARMCO Tunnel Liner Plates are designed for utmost strength with the least possible weight.

This means that one unskilled workman can carry, hold and bolt into place an Armco liner section. Only a structural wrench is needed. Labor costs are low and the job goes fast. Less bulk also means less excavation, and storage requirements are smaller. With ARMCO Plates you buy no excess metal, and this keeps job costs down.

You'll find ARMCO Liner Plates the simplest, most inexpensive way you ever saw to install conduits, sewers and similar structures. You avoid the hazards and inconvenience of open trenching and business above ground continues as usual. Use ARMCO Tunnel Liner Plates on that next job to "hole through" ahead of schedule and under the estimate. Write for data. Armco Drainage & Metal Products, Inc., 1195 Curtis St., Middletown, Ohio. Offices in Principal Cities.

ARMCO
TUNNEL LINER PLATES

MEN AND JOBS

Brig. Gen. D. A. D. Ogden is commanding general of the Second Engineer Special Brigade now stationed at Fort Worden, Wash., on Puget Sound, the brigade having been designated for retention in the peacetime Army. This is in recognition of the valuable work rendered by the six Engineer Special Brigades developed in 1942 under Maj. Gen. Daniel Noce, who then commanded the Engineer Amphibian Command. These units were used in the European and Southwest Pacific theaters of operations and had a distinguished record aiding landing operations with full logistic support. Their work in the Southwest Pacific was highly commended by General Douglas MacArthur, General Walter Krueger, and Lieut. General Robert L. Eichelberger.

The Second Brigade returned from Tokyo in December 1945, and has since been stationed on the West Coast—at Camp San Luis Obispo, Fort Emory, Coronado, Calif., and Fort Ord, Monterey, Calif.

Dennis W. Doyle and **Frank T. Finnegan** have opened an office at 180 Genesee St., Utica, N. Y., for the general practice of civil engineering. Both men have recently been associated with the U. S. Engineers.

R. E. Reynolds has resigned as city engineer at Tabor City, N. C., to become a partner in the Eustler and Reynolds Engineering Co. at Whiteville, N. C.

Two merit awards were presented to **Edgar J. Lyons** at Rochester, N. Y., recently because of "very valuable engineering suggestions and data for highway design and survey". They were made by the New York State Civil Service Department. Mr. Lyons has been a state highway engineer for 23 years.

Col. Benjamin R. Wimer, 1929 of West Point, has been assigned to Atlanta, Ga., as executive officer to Col. G. W. Gillette, division engineer of the South Atlantic Division, Corps of Engineers. Colonel Wimer received his B. S. in civil engineering in 1932 from the University of California. From 1932 to 1936 he was assigned to Fort Belvoir and since 1940 has been on military construction work at the Galveston, Tex., district. He was deputy, later district engineer at Honolulu 1942-45. In 1945 he was engineer for the 5th Air Force and later commanded the Engineer Construction Group near Tokyo, Japan, during early occupation.

Jack Dean has been appointed city manager and city engineer of Bessemer, Ala. He was formerly city engineer at Albany, Ga. **Earl Olson,** Louisville, Ky., will succeed Mr. Dean as city engineer at Albany.

Albert M. Kircher has retired as city engineer of Mankato, Minn., and opened a private office for the practice of engineering. He has been succeeded by **Thomas Mackey.**

Governor Walter W. Bacon, of Delaware, has reappointed **Clayton A. Bunting,** of Selbyville as resident member of the Delaware State Highway Department for a 6-year term. He succeeds **C. D. Abbott** of Milford, Del. Other members of the department are **F. V. DuPont** of Wilmington, chairman; **Ralph W. Emerson,** Wyoming; **Donald P. Ross,** Montchanin; **Dallas D. Culver,** Seaford; **William H. Speer,** Wilmington, and **J. Gordon Smith,** Dover.

Claude W. Beck has been appointed field engineer in charge of construction of Camp Mongold, temporary project town at Detroit Dam on the Santiam River in Oregon. He has been in charge of the dismantling of Camp Adair and the Corvallis air field.

William J. Wenzel, formerly chief engineer of Corwin & Co., Great Falls, Mont., has opened a consulting engineer office at 409 First Ave., S. W., in Great Falls.

A. V. Saph, Jr., San Francisco consulting structural engineer, has been appointed by Gov. Earl Warren as third member of the state board of registration for civil engineers. He will replace **Mark Falk,** who resigned. Saph is a graduate of the University of California, where he received his civil engineering degree in 1917. After serving in the Navy in World War I he joined his father's consulting firm.

Col. William Whipple, recently of the office of military government in Germany, has arrived in Portland, Ore., to become executive officer to Col. Theron D. Weaver, North Pacific division engineer, Corps of Engineers. In July, Colonel Whipple will replace **Col. George W. Zimmerman,** deputy division engineer, who will attend the Industrial School for Armed Forces at Washington, D. C.

Designers put this project on an Economical Permanent Footing with

KOPPERS
PRESSURE-CREOSOTED PILES

A common problem—providing a firm, *enduring* foundation in unstable soils—faced the designers of this large industrial building. To solve it, they chose a pile material whose permanence and economy have been conclusively demonstrated in thousands of applications—pressure-creosoted wood.

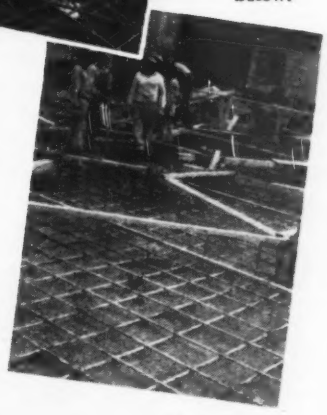
Koppers Pressure-creosoted piles were driven in the wall trench, and under the floor area. These multiple supports eliminate settling hazards. The treatment gives enduring protection against decay, permitting cut-offs above the water table to be safely made. It also fortifies the piles against insect attack.

The *permanence* of pressure-creosoted piles is demonstrated by the old buildings founded on them . . . and present-day *economy and effectiveness* are indicated by the many modern buildings that use this proven method of overcoming soil handicaps. Koppers Pressure-creosoted piles permit economical development of areas where water tables are below pile cut-offs. They provide adequate bearing value in constructing foundations for heavy bridges or machinery. And they are an accepted means of equalizing support when part of the building is over filled or soft ground.

Koppers is equipped to treat piles up to 125 feet in length, and the delivery situation is excellent. If you have a foundation problem, get in touch with Koppers.

Piles in trench will be capped by wall; others by floor slab.

Reinforcing rods for floor slab. Piles can be seen below.



Floor partially poured. Lower reinforcing is covered.

KOPPERS PRESSURE-TREATED WOOD

KOPPERS COMPANY, INC.

PITTSBURGH 19, PENNSYLVANIA

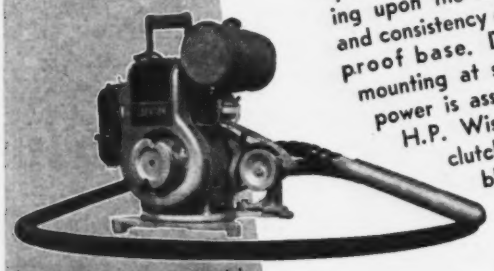
JACKSON MODEL FS-6A

for THOROUGH, EFFICIENT VIBRATION of CONCRETE

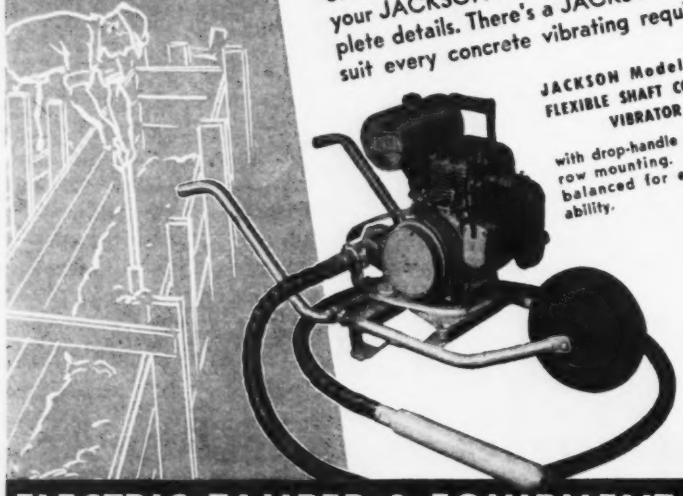
ANYWHERE — ANY TIME on a WIDE VARIETY of JOBS!

With this thoroughly proved, highly dependable engine-driven flexible shaft vibrator you are all set at a moment's notice to do a perfect job of concrete vibrating on a large variety of jobs, and to effect very appreciable labor and cement savings as well as achieving better quality in the finished product.

It is available with four interchangeable heads ranging from 1¾" x 10¾" to 2⅜" x 18⅝"; and since the vibrator speed may be quickly and positively adjusted, size of head and amplitude may be perfectly balanced to suit each type of job. Top frequency is from 7,000 to 7,500 VPM depending upon the length of flexible shaft used and consistency of concrete. Full swivel, dirt-proof base. Drop-handle wheelbarrow mounting at small extra cost. Plenty of power is assured by the dependable 4 H.P. Wisconsin engine. Automatic clutch saves engine wear. Flexible shaft is furnished in 7' and 14' lengths up to 28'. Equipped with new and improved reduction pulley for driving grinding heads most efficiently for wet or dry rubbing. See the FS-6A and the other highly efficient JACKSON Vibrators at your JACKSON Distributor or write for complete details. There's a JACKSON to ideally suit every concrete vibrating requirement.



In this view of the Model FS-6A note the two speed pulleys for most efficient shaft speeds for operation of vibrator and grinder heads.



JACKSON Model FS-6A FLEXIBLE SHAFT CONCRETE VIBRATOR with drop-handle wheelbarrow mounting. Perfectly balanced for easy portability.

ELECTRIC TAMPER & EQUIPMENT CO.
LUDINGTON MICHIGAN

Lawrence Bramble has been appointed city engineer for Essex, Iowa. He succeeds **F. D. Hilgerson.**

Joseph M. Watson has been named fourth division engineer for the Florida State Road Department with headquarters at Fort Lauderdale, succeeding **Nathan S. Emery,** who resigned to become Florida representative of a Kentucky roadbuilding firm. Mr. Watson joined the department in 1925 and is a graduate of the Alabama Polytechnic Institute. He was a lieutenant commander in the Navy Seabees.

Ben L. Williamson has succeeded **Paul Haney** as chief engineer, division of sanitation, Kansas State Board of Health, with headquarters at the University of Kansas. Williamson was formerly with the state highway commission.

Vance P. Perry, Keith P. Bowman and L. L. Mallard of Kinston, N. C., have formed a general engineering firm to be known as the Eastern Carolina Engineering Co.

Jacob Johns has been appointed Canton, Ill., superintendent of streets to replace Elmer Altiser; Howard Gibbons was reappointed city engineer. Rella Johnson was named chief operator of the sewer treatment plant.

A. Judson Warlow has resigned as chief engineer of the department of property and supplies at Harrisburg, Pa., and is succeeded by **Allen F. Jones.**

Arndt Eklund, who has been an employee of the Marinette County, Wis., highway department for 42 years, the last nine of which he was commissioner, has resigned.

R. Herbert Dann, a member of the engineering division of the department of public works, has been named acting city engineer of Superior, Wis.

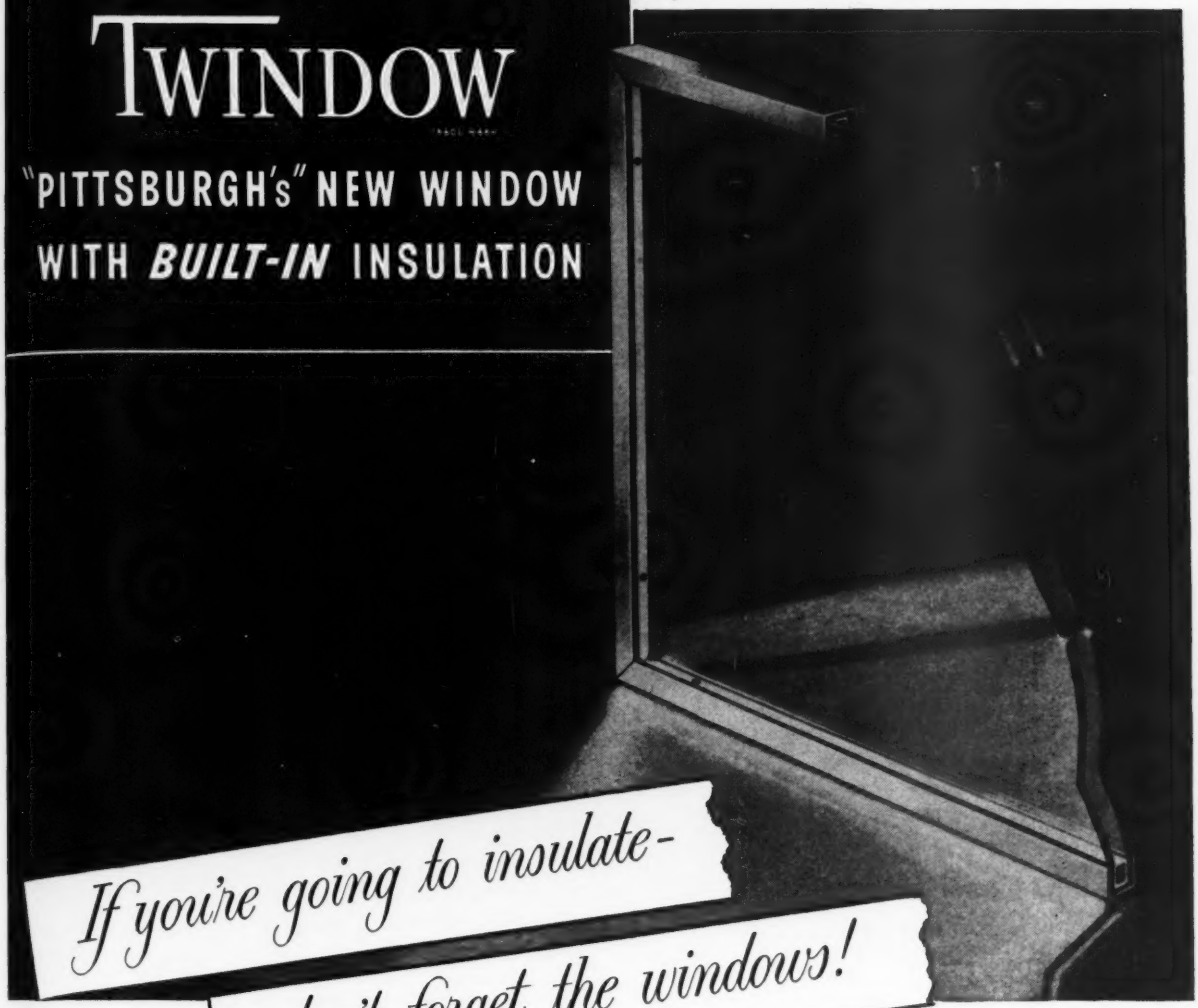
George D. Brissette has resigned as city engineer of Menominee, Mich., to go with the Limestone Products Co. of that city.

C. A. Stollery has been named manager and chief engineer of the Poole Construction Co. Ltd., Calgary, Alta. Mr. Stollery served as lieutenant commander with the Royal Canadian Navy in the war and previously was engaged in large construction projects in eastern Canada and South America.

J. F. Bivens, city engineer at Mount Airy, N. C., for the last five years, has resigned to become resident engineer

TWINDOW

"PITTSBURGH'S" NEW WINDOW WITH *BUILT-IN* INSULATION



If you're going to insulate—

don't forget the windows!

In any kind of building, you can increase the total effectiveness of insulation by installing Twindow. This latest product of "Pittsburgh" research has nearly twice the insulating efficiency of ordinary windows. When made with more than two panes of glass, its efficiency is even greater. And it installs as simply as a single pane of glass.

Twindow's additional insulation means extra comfort . . . more healthful living . . . greater heating and air-conditioning economy. It means your calculated heat loss will be substantially smaller . . . your cooling load will be lighter. It means you can satisfy heating and cooling requirements with smaller equipment . . . equipment that costs less to buy, less to operate.

With Twindow making your insulation job more efficient, you'll find it easier to maintain proper temperature and humidity throughout the year. Drafts will be minimized. In addition, Twindow won't frost or steam except under very severe conditions.

You'll find Twindow ideal . . . for picture windows in homes and hospitals . . . for more and larger windows in stores, offices, factories, public buildings . . . for refrigerated display cases.

For more complete information, write us today. Address Pittsburgh Plate Glass Company, 2205-7 Grant Building, Pittsburgh 19, Pa.

PPG "PITTSBURGH" *stands for Quality Glass and Paint*

PITTSBURGH PLATE GLASS COMPANY

Carefully engineered, well-built Plymouth Locomotives can turn in low-cost performance records under almost any operating conditions. For example, in quarry work where temporary, make-shift roadbeds create unusually rough track conditions, a Plymouth can provide dependable, economical service, hauling a trainload of stone with ease. Compact, powerful, requiring only a minimum of maintenance, a Plymouth can spot cars where and when they're wanted, regardless of track conditions. If that's the kind of service you're looking for—economical performance under the most difficult operating conditions—then you'll want to know more about Plymouth Locomotives. Write today for complete information.

PLYMOUTH LOCOMOTIVES

GASOLINE, DIESEL MECHANICAL AND DIESEL ELECTRIC

PLYMOUTH LOCOMOTIVE WORKS • Division of The Fate-Root-Heath Co., Plymouth, Ohio, U.S.A.

with the North Carolina State Highway Department in Stokes County.

L. J. Selly, 70, who has been connected on and off with the Rio Grande project of the Reclamation Bureau since before the dam was built at Elephant Butte, N. M., has retired after more than 37 years service with the bureau. In 1911 he was sent to Elephant Butte to oversee construction of housing for dam builders. Two years later he was transferred to the irrigation canals project. In 1915 he left the bureau, returning at the beginning of construction of CCC camps. In 1941 he became general foreman of construction at Elephant Butte, till he retired.

Appointments have been announced by the Pennsylvania Highway Department as follows: District 4, Scranton: **Joseph S. Weir,** Wyoming, project engineer. District 12, Uniontown; **Bert W. Benson,** Canonsburg, project engineer, **Frank R. Barr,** Washington, project engineer.

Jacob Eakin, assistant Sandusky County engineer at Fremont, Ohio, has taken a leave of absence to direct construction of the new $1,250,000 Huron Bridge on Route 6 over the Huron River for the Ohio Highway Department.

Lt. Comdr. H. W. Schleiter of the U. S. Coast Guard is now stationed at Seattle, Washington. A civil engineering graduate of the University of Minnesota, he probably will be assigned public works activities.

Ted Jensen, formerly in charge of the design and construction office of Branch 8, Veterans Administration Office in St. Paul, Minn., has resigned to go with the Atomic Energy Commission at Sante Fe, N. M.

Ernest E. Michaels has been promoted to general manager of all operations of the Chicago Bridge & Iron Co. He had been manager of the Birmingham, Ala., branch since 1930. He is also a vice-president. He will be succeeded as manager of the Birmingham plant by **Amasa G. Smith,** who has been plant superintendent since 1943.

Engineering associates of the late **U. Ernest Nelson,** who died recently at Portland, Ore., will retain the name of the firm of U. Ernest Nelson & Associates, with business to be conducted under the direction of **Arthur H. Mayne,** who was associated with Mr. Nelson during the last year. Formerly he was engaged in utilities engineering on Army and Navy installations, having been in charge of sanitation engineer-

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ing in Alaska on the Alaska highway during the war. Associated with him is **Thomas Smithson,** formerly of Bend, Ore., who was attached to the Sanitation Corps of the Army.

Carl H. Cotter, retired recently from the Navy with the rank of rear admiral after 29 years in the Corps of Civil Engineers, has become connected with Blythe Brothers Construction Co. at Charlotte, N. C. He obtained his civil engineering degree from the University of Michigan in 1918 and then entered the Navy. During the war, posts which he held included director of the Pacific and Western Pacific divisions of the Bureau of Yards and Docks, and deputy commander of Naval construction battalions.

Edward C. Dohm, city project engineer at Olympia, Wash., has resigned to engage in private engineering practice.

Norman McRae, formerly resident highway engineer at Coeur d'Alene, has been appointed Idaho highway maintenance engineer. He succeeds **E. W. Swan,** who resigned to work for Wallace, Idaho.

W. R. Robertson has resigned as mine efficiency engineer with the Fresnillo Co. in Mexico, and is returning to establish his practice as consulting mining engineer, at 7106 N. E. Roselawn St., Portland, Ore.

William Gammon, town engineer of New Glasgow, N. S., has resigned.

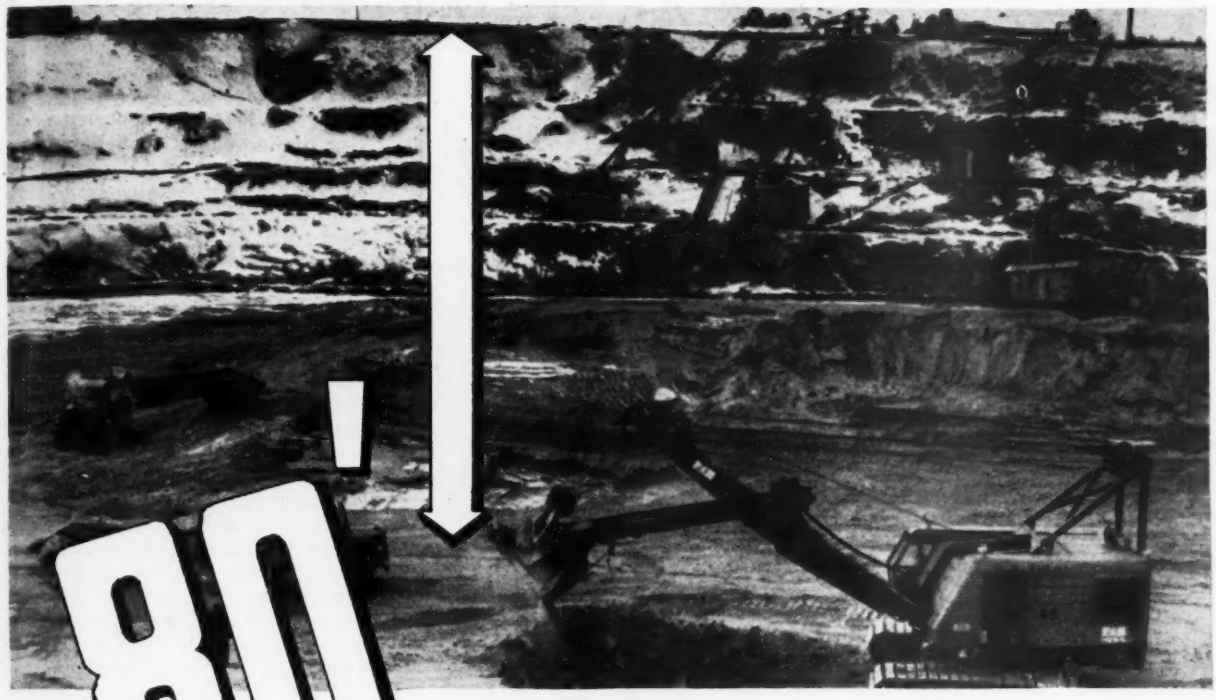
Col. E. V. Spence has been elected chairman of the Texas State Board of Water Engineers, succeeding **C. S. Clark,** resigned. **H. A. Beckwith** has taken office as Clark's successor on the board.

Francis R. MacLeay, construction engineer, has been appointed a member of the municipal housing authority at New Rochelle, N. Y., and he will be chairman of the 5-man commission. He is chief engineer of the Corbetta Construction Co., New York City. A civil engineer graduate of Northeastern University, Boston, Mass., Mr. MacLeay is an expert on low-cost housing and has been connected either in design or construction with many important projects.

Boice Macon, engineer with the North Carolina State Highway Commission at Mount Airy for the last 18 months, has resigned to accept a government post as a civil engineer in connection with rebuilding war-torn areas on Okinawa.

DIGGING DEEP and DRY

AT NEVERSINK DAM, NEW YORK



Eighty feet of water on this $20,000,000 project for the Board of Water Supply, New York, was lowered below subgrade by successive stages of MORETRENCH WELLPOINT EQUIPMENT. Material—clayey sand.

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UNITED STATES STEEL

Elections and Activities

James W. Engle, chief of the utilities branch of the military engineering division, Corps of Engineers, U. S. Army, has been elected president of the Maryland-Delaware Water and Sewerage Association. (ENR May 22, vol. p. 857). He succeeds Clarke Gardner, city engineer of Salisbury, Md. R. C. Willson, water superintendent, Hagerstown, Md., is the new first vice-president, and A. A. Bailey, of the operating staff of the Montebelle filtration plant, Baltimore, second vice-president. Miss E. V. Gipe, of the Maryland Department of Health, continues as secretary-treasurer.

James D. Mooney, president and board chairman of Willys-Overland Motors, Inc., of Toledo, has been elected president of the Ohio Good Roads Federation. Hal G. Sours, of Baldwin-Sours, in Columbus, has been named first vice-president. W. Robert Timken, vice-president of Timken Roller Bearing Co., Canton, has been made second vice-president, while the third vice-president's post will be filled by Guy C. Baker, vice-president and general manager of American Aggregates Corp. of Greenville. Floyd W. Mohler is executive secretary of the Federation.

Edmonton, Alta., branch of the Engineering Institute of Canada has elected J. E. Cranswick, president and W. W. Preston, secretary-treasurer; H. G. Williamson, E. H. Wright, E. K. Cummings, D. Ross and D. K. Campbell, governors, and F. R. Burtfield, resident councillor.

Roger J. Evans has been elected president of the Engineers Club of Trenton, N. J. Other officers are: Joseph P. Clar, first vice-president; Hans Gartmann, second vice-president; A. D. Bullock, treasurer; Fred C. Claus, secretary for his eleventh term, and the following directors: Robert N. Blakeslee, Jr., Edward C. Gainsborg, Elliott F. Daniels, R. Wesley Davis, Frederick A. French, J. Russell Hemeon, M. J. Kearney, Past Presidents Edward H. Kotz and Blair Birdsall will serve as directors for two years.

H. C. Clare, Boise, Idaho, director, Health Engineering Division, Idaho Department of Public Health, has been elected president of the Pacific Northwest Sewage Works Association. Other officers are K. H. Spies, Portland, Ore., first vice-president; E. C. Jensen, Seattle, Wash., second vice-president; C. M.

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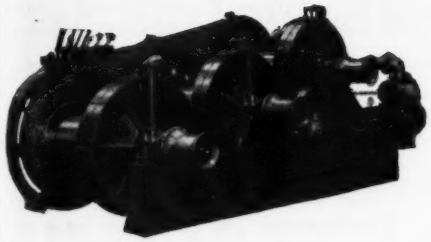

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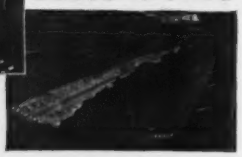

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Howard, Seattle, Wash., member, Federation Board of Control; and W. P. Hughes, Lewiston, Idaho, secretary-treasurer.

G. B. Schunke, assistant superintendent, Seattle, Wash., Water Department, was awarded the George W. Fuller Memorial Award at the recent Victoria, B. C., meeting of the Pacific Northwest Section, American Water Works Association. This award is presented annually to a member considered to have performed outstanding service in the water works field. Officers installed were as follows: Chairman, S. J. Benedict, principal assistant engineer, Water Department, Portland, Ore.; vice-chairman, J. E. Morrison, city engineer, Renton, Wash.; secretary-treasurer, Fred Merryfield, professor of civil engineering, Oregon State College, Corvallis, Ore.; board of trustee member, Elmo James, water department superintendent, Spokane, Wash.; and national director, W. J. Moore, water superintendent, Eugene, Ore.

Guy H. White was elected and installed as president of the Engineers Club of Western North Carolina at a recent meeting at Asheville. Other new officers are: G. I. Thurmond, vice-president; Walter H. Bearden, secretary; Lawrence Hurt, treasurer; and Lawrence Merchant and Clyde Hoey, Jr., directors.

The Washington State Association of County Engineers has elected August Hanson of Klickitat County as president, with Charles E. Neville of Lewis County as vice president, Clyde Chaffins of Spokane as secretary-treasurer and Charles Deako of Clark as head of the executive committee.

The Lead Industries Association has elected Robert Lindley Ziegfeld acting secretary and treasurer. K. C. Brownell vice-president, member of the executive committee and the board of directors. D. N. Burruss, Jr., was elected a director. All other officers and directors were re-elected.

A meeting to establish a metropolitan section of the New York State Sewage Works Association was held at New York University on May 13 attended by some 60 members. Seth G. Hess, chief engineer of the Interstate Sanitation Commission, was elected chairman and George Symonds, associate editor of "Water and Sewage Works," was made secretary. The group will petition the parent body for recognition as a duly constituted local section.

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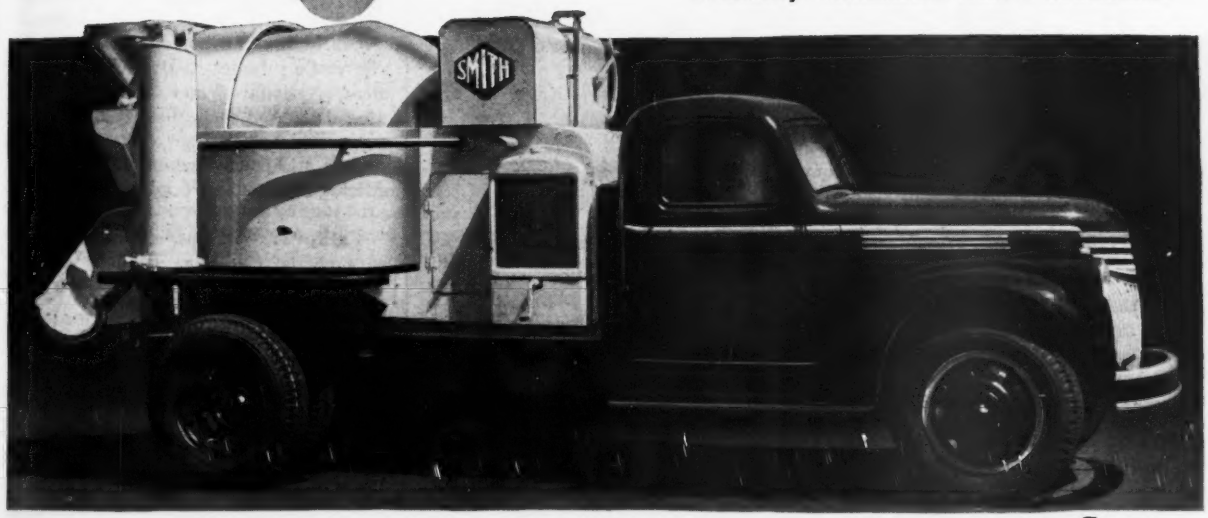

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gineers recently elected these officers: E. W. Lehmann, president; L. C. Ruby, vice-president; and Edward M. Anderson, secretary-treasurer. Milton T. Holloway is the newly appointed field secretary for the society. The chapter has recently admitted to membership: John Stall, assistant engineer, Illinois Water Survey; and Don H. Dragoo, division engineer office, Illinois Power Co.

Wendell R. LaDue, Akron, Ohio, president of the American Water Works Association, told the 39th annual meeting of the Indiana Section at Indianapolis, May 8, that industries, as never before, are supporting efforts to prevent stream pollution. He urged water works officials to join in the expansion of this program, explaining the value of research, good public relations, voluntary high standards of service and public education in such matters. Other speakers were Dr. Leroy E. Burney, Indiana State Health Commissioner; Otto K. Jensen, executive secretary, Indianapolis Redevelopment Commission; Fred R. Witherspoon, senior water works engineer, Public Service Commission; H. J. Draves, superintendent, Michigan City Water Works; Lewis S. Finch, chief engineer, Indianapolis Water Co.; James R. Brown, vice-president, National Water Main Cleaning Co.; Don A. Leach, district sales manager, Chicago Bridge & Iron Works, and O. M. Leonard, consulting engineer, Michigan City.

Philip T. Williams, executive secretary of the Carolinas Branch, Associated General Contractors of America, with headquarters at Charlotte, N. C., since December 1946, has resigned and Robert Patten of Ocala, Fla., has been named to succeed him.

The Montana Sewage Works Association has elected Kenneth Winebrenner of Kalispell as chairman, with F. F. Palmer of Forsyth as vice-chairman, Kenneth Chrysler of Billings as director and Fred E. Brandis of Chinook and Joe Wright of Lewiston as trustees. H. B. Foote, director of the division of sanitary engineering, state board of health, continues as secretary-treasurer. The Kenneth Allen award for outstanding service and leadership, and technical contributions in the sewerage and sewage treatment works fields, went to W. M. Cobleigh, dean emeritus of the Montana State College school of engineering.

Stewart Voden, of the Great Falls water department, is the new president of the Montana Section, American Water Works Association. John B. Hazen of Butte is vice-chairman; C. W. Brinck, Helena, secretary-treasurer;

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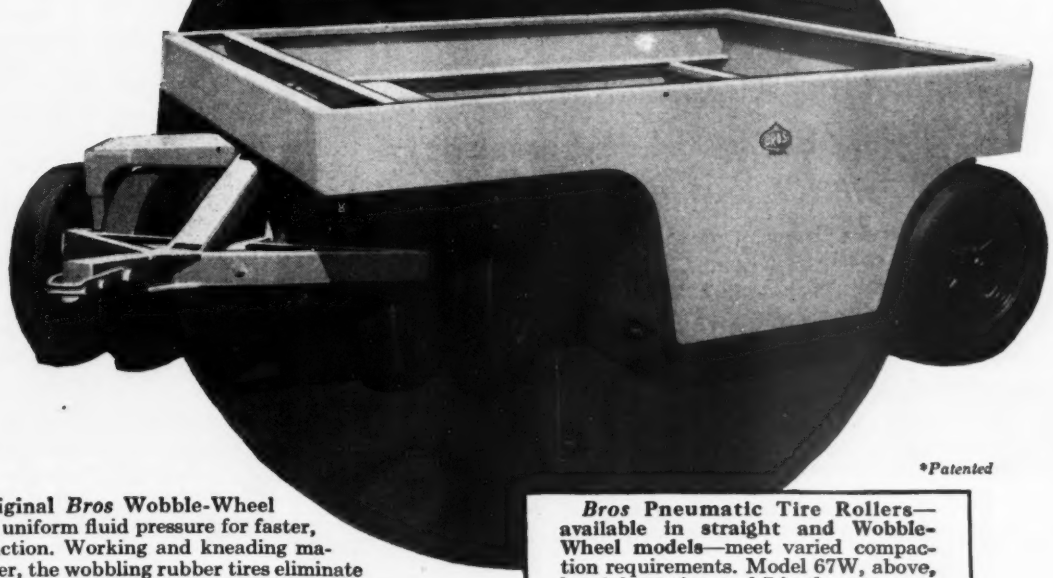
For Fluid Pressure Compaction



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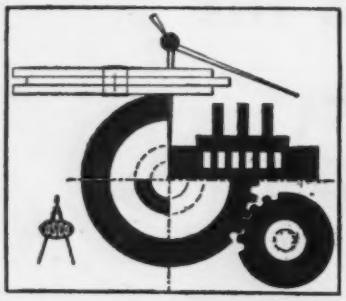

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J. R. Cortese, Livingston, director, and M. F. Dixon of Billings and W. R. Border, Bozeman, trustees.

The Engineering Society of Buffalo, N. Y., has elected: George T. Parker, Jr., president; Horman J. Hulbert, vice-president; George L. Burns, secretary; J. Lloyd Walker, treasurer. Directors elected are Alexander Grabhorn, George R. King, Clarence J. Hayes and Volney M. Holmes.

The Steuben, N. Y., Area chapter, Society of Professional Engineers, has elected the following new officers: President, Arthur C. Fairchild, Elmira; first vice-president, Richard C. Gorman, Hornell; second vice-president, Walter E. Smith, Corning; secretary, Samuel K. Wolcott, Jr., Elmira; treasurer, Robert M. Campbell, Alfred.

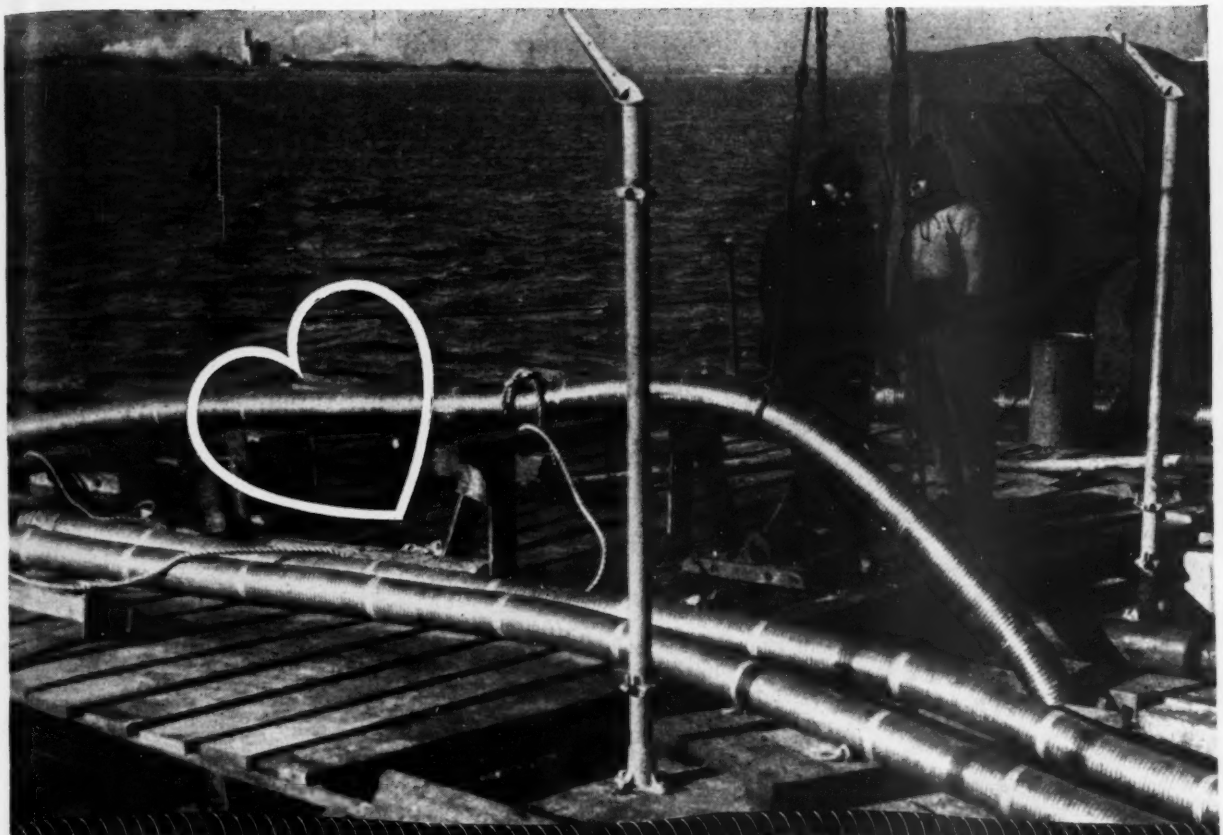
The Nebraska chapter of the National Concrete Masonry Association has elected: Earl Peterson, Omaha, president; M. W. Finney, Grand Island, and Chris Hanley, Chappell, vice-presidents; Paul Moser, Lincoln, secretary; and H. J. Young, Wahoo, treasurer.

John W. Johnson, superintendent of the sewage treatment plant, Buffalo, N. Y., Sewer Authority, has been installed as president of the Erie County Chapter, State Society of Professional Engineers. Other officers installed were: vice-president, Henri B. Vidal; secretary, Elmer A. Hilburger; treasurer, Arthur B. Weaver; directors, Joseph Davis, Glenn H. Dewey, C. Arnold Dutton, William E. S. Dyer, Melvin C. Kelly, Henry F. Sproull and Eugene A. Eldridge.

Officers of the Florida Engineering Society have been elected as follows: Milton B. Garris, president; Wylie Gillespie, first vice-president; A. P. Michaels, second vice-president; David B. Lee, secretary (re-elected); and Raymond Chase, treasurer (re-elected).

The newly formed Construction Employers' Council, Inc., at Atlanta, Ga., has been launched with J. P. Wey as president; E. M. Meyers, vice-president; and Merrill P. Wilson, secretary. The purpose is to help reduce the cost of building, working in conjunction with labor organizations.

The speaker at a recent meeting of the Engineers Club of Hampton Roads, Va., was H. E. Foreman, managing director, of the Associated General Contractors of America, on "Engineer-Contractor Relations, A Way to More Economical Construction". He stressed the need for cooperation between contractors and engineers; simplification of



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design, construction, and contractual procedures; and elimination of non-essentials, along with the necessity of adequate, clear, and definite specifications.

At the annual meeting of the South Dakota Society of Engineers and Architects E. W. Meeker, state highway engineer, was elected president, succeeding Kenneth R. Scurr of Pierre, who was elected vice-president. W. W. Towne, of Pierre, was re-elected secretary-treasurer. Mr. Towne is director of the division of sanitary engineering, South Dakota State Board of Health, Council members are W. E. Thompson, Belle Fourche; C. H. Sinclair, Huron; Emery Johnson, Brookings; and John Schoening, Sioux Falls.

L. W. Grace, St. Peter, Minn., Nicollet County highway engineer, has been named president of the Professional Engineers of the Second District in Minnesota; Nels Johnson, Mankato, of the state highway department, was elected vice-president; and Stan Ekern, Mankato, secretary.

J. M. Chandlee, service manager for the Century Electric Co., has been elected president of the Engineers' Club of St. Louis, Mo. Other officers are: Brice R. Smith, first vice-president; R. Earl Salveter, second vice-president; Robert C. Thumser, third vice-president; and M. D. Dawson, treasurer. Directors are J. W. Hubler, R. G. Grote, W. R. Crecelius, Neal J. Campbell, R. S. Glasgow and A. Carl Weber.

Officers of the N. Y. State Society of Professional Engineers, Inc., have been elected as follows: President, William H. Larkin; first vice-president, William W. Perry; second vice-president, George J. Nicastro; financial secretary, Ernest F. Fox; treasurer, Patrick M. Corry; directors-at-large, Chester W. Cambell, Frederick W. Malkmus, and John B. Walsh.

Joseph A. Reece, Surface Combustion Corp., has been elected president of the Toledo, Ohio, chapter, Ohio Society of Professional Engineers. He is organizer of the Toledo Technical Council, now composed of 19 member societies and 2,000 engineers, which was formed in 1940. Other new officers are Harlan G. Wood, vice-president; A. E. Fryer, secretary; William Steinhauer, treasurer; Raymond Hall and Maynard Curtis, directors, and R. M. Hanselman, Rossford, director for Wood County.

The Niagara County Chapter of the New York State Society of Professional Engineers has recently elected the following officers; Elbert H. Coe, president; Walter M. Buehl, vice-president; Joseph I. Lacey, secretary; and Maxwell Whitacre, treasurer. Charles M. Kirk and Almer J. Thompson were elected directors.

The Seattle, Wash., post of the Society of American Military Engineers has elected Fred H. Rhodes, Jr., University of Washington professor, as its new president. Other officers are Capt. Carl F. Ganong, Coast Guard, vice-president; George F. Hopkins, secretary; Wallace R. Davidson, treasurer; Lieut. Col. Robert E. Blasen, program director; John V. Story, entertainment chairman, and Cotton M. Howard, membership chairman.

H. S. Crain has been elected president of the Durham, N. C., Engineers Club to succeed T. C. Cooke. Other officers elected are: John W. May, vice-president; Guy H. Bennett, secretary; George F. Hackney, treasurer; and Alton Skinner, Jr., and Frank Dieter, directors.

These officers of the Nebraska Engineering Society have been elected: C. F. Moulton, Omaha, president; H. C. Schleuter, Lincoln, vice-president and J. S. Blackman, Lincoln, secretary-treasurer. Ben C. Dale, of Falls City, and T. L. Fran of Omaha directors.

Public health and its relation to housing was one of the main topics presented before the Western Branch, American Public Health Association in its first postwar meeting held in San Francisco May 27 to 29. A. A. Twitchell, secretary of the APHA committee on housing, reviewed the progress of work by his group on standards of housing from the health standpoint. He advocated the abandoning of the old cubic-foot basis for minimum room and house sizes for a square-foot basis.

Charles Senn, engineer-director of sanitation for Los Angeles County, outlined the progress in Los Angeles in the reduction of sub-standard houses. By use of 200 living units, some 1,500 families were established in better quarters recently.

Richard Graves, secretary, league of California cities, in speaking on community planning questioned the public health organization of some localities where both a municipal and county health agency exist.

The organization of the graduate program in public health and sanitary engineering at the University of California was reviewed by Prof. Harold B. Gotaas and other faculty members. California is one of the two schools in the United States where these two programs are integrated and engineers can be trained directly for public health work.

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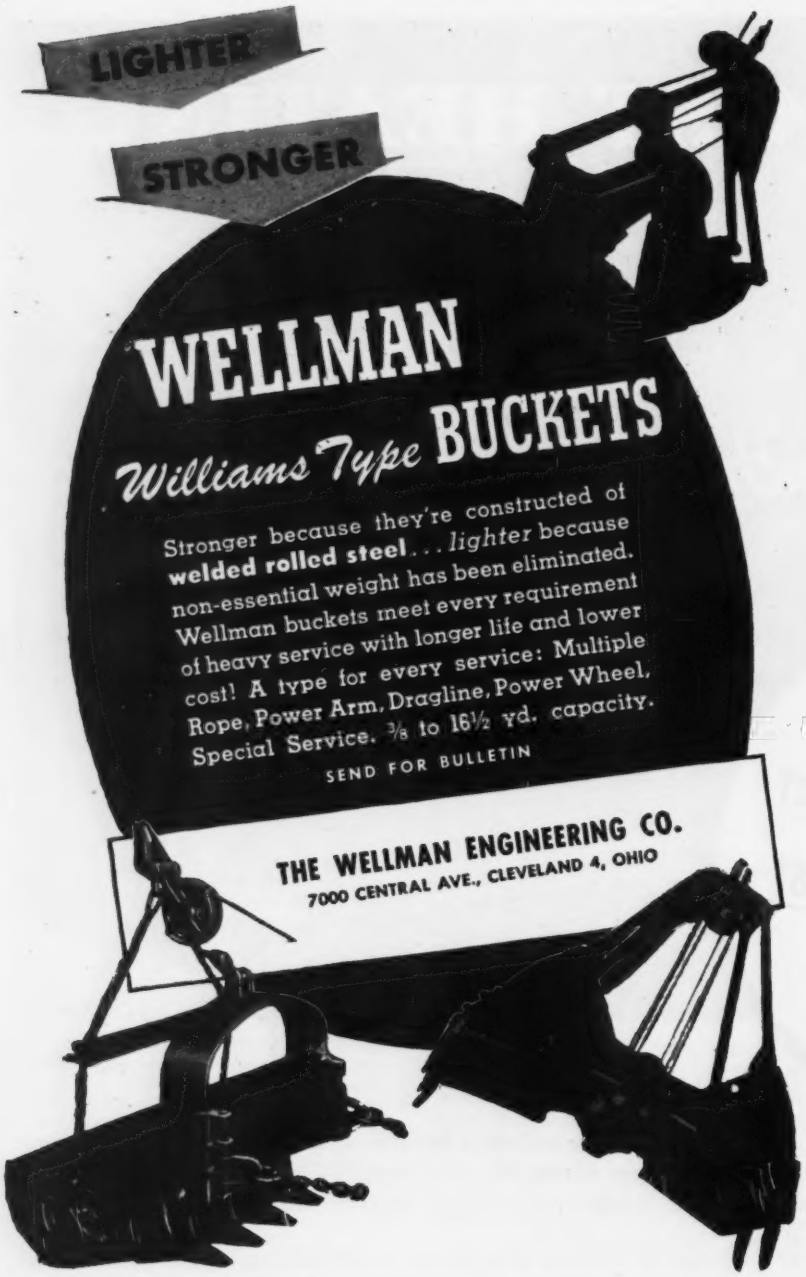
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New Engineering Books

(*Continued from page 128*)

CHICAGO'S REPORT TO THE PEOPLE—372 pp. Obtainable from the City Council, City Hall, Chicago, Ill.

THERMAL INSULATION OF BUILDINGS—By P. D. Close. 104 pp. Reinhold Publishing Corp., New York 18. $1.75.

60 YEARS WITH MEN AND MACHINES—By Fred H. Colvin. 297 pp. Whittlesey House, McGraw-Hill Book Co., New York 18, and London. $3.50.

OFFICIAL DIRECTORY AND GUIDE—1947—343 pp. Building Construction Employers' Assoc. of Chicago, 228 N. LaSalle St., Chicago, Ill.

THE GREAT NATIONAL PROJECT: A HISTORY OF THE CHESAPEAKE AND OHIO CANAL—By Walter S. Sanderlin. 331 pp. Johns Hopkins Press, Baltimore 18, Md. $3. paper bound, $3.75 cloth bound.

THE CASE FOR REGIONAL PLANNING WITH SPECIAL REFERENCE TO NEW ENGLAND—By the Directive Committee on Regional Planning, Yale University. 94 pp. Yale University Press, New Haven, Conn. $10.

CLIMATE AND THE ENERGY OF NATIONS—Second American Edition—By S. F. Markham. 240 pp. Oxford University Press, 114 Fifth Ave., New York 11, London and Toronto. $4.50.

ECONOMIC ROADS FOR AMERICAN DEMOCRACY—W. Van Til. 252 pp. McGraw-Hill Book Co., New York 18, and London. $1.80.

SIX-PLACE TABLES—Seventh Edition—By E. S. Allen. 232 pp. McGraw-Hill Book Co., New York 18, and London. $2.50.

CONSTRUCTIVE COLLECTIVE BARGAINING—By E. T. Cheyfitz. 161 pp. McGraw-Hill Book Co., New York 18, and London. $2.

DRAUGHTSMANSHIP—By R. Fraser Reekie. 197 pp. Edward Arnold & Co., London. Longmans, Green & Co., New York. $3.

INDEX SUMMARY OF THE NEW CHICAGO BUILDING CODE—By E. E. Reddersen. 237 pp. Obtainable from the author, 703 Buena Ave., Chicago, Ill. $10.

ARCHITECTURE—AN ART FOR ALL MEN—By Talbot Hamlin. 279 pp. Columbia University Press, New York. $3.50.

UNIFIED CALCULUS—By E. S. Smith, M. Salkover and H. K. Justice. 507 pp. John Wiley & Sons, New York 16, Chapman & Hall, London. $3.50.

CITIES OF AMERICA—By G. S. Perry. 287 pp. Whittlesey House, McGraw-Hill Book Co., New York 18, and London. $3.50.

THE PROBLEM OF REDUCING VULNERABILITY TO ATOMIC BOMBS—By A. J. Coale. 116 pp. Princeton University Press, Princeton, N. J. $2.

Reports and Pamphlets

STANDARD PLANS FOR DRIVEWAYS—Department of Highways, Baton Rouge, La.

HIGHWAY STATISTICS—1945—Public Roads Administration. For sale by the Superintendent of Documents, Washington 25, D. C. 35c.

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Writes War Veteran Grant Sims

Here's a fellow who really knows truck engines. Official of an important motor freight line before the war, he spent 35 months overseas in command of a GMC-equipped mobile aircraft salvage unit. Today he is Superintendent of Maintenance for the Salt Lake Transfer Company.

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TECHNICAL STANDARDS FOR PROPERTY SURVEYS—Reprinted from *Surveying & Mapping.* American Congress on Surveying & Mapping, Washington 4, D. C.

A NEW ERA IN SURVEYING AND MAPPING CURRICULA—By George H. Hardy. Reprinted from *Surveying & Mapping.* American Congress on Surveying & Mapping, Washington 4, D. C.

MOISTURE CONDENSATION—University of Illinois Small Homes Council Circular F6.2. Mumford House, University of Illinois, Urbana, Ill.

THE HIGHWAY TRANSPORTATION PROBLEM IN MICHIGAN—Michigan Good Roads Federation, 512 Tussing Building, Lansing 7, Mich.

BIBLIOGRAPHY OF DIAMOND DRILLING—1947 Edition—E. J. Longyear Co., Foshay Tower, Minneapolis 2, Minn.

COMPREHENSIVE CITY PLAN—City Plan Commission, St. Louis, Missouri. $5.

AMERICAN CAN NOT AFFORD SLUMS—United States Conference of Mayors, Washington, D. C.

MODERN BUILDING WITH WOOD—Timber Engineering Co., Washington 6, D. C.

TEMPERATURE DISTRIBUTION IN A TEST BUNGALOW WITH VARIOUS HEATING DEVICES—By R. D. Dill and P. R. Achenbach. National Bureau of Standards. For sale by Superintendent of Documents, Washington 25, D. C. 10c.

CALIFORNIA CONSTRUCTION IN 1946—State Reconstruction and Reemployment Commission, 631 J St., Sacramento 14, Calif.

HIGHWAY PLAN FOR SHREVEPORT, LOUISIANA—Department of Highways, Baton Rouge 4, La.

INFLUENCE CHARTS FOR COMPUTATION OF VERTICAL DISPLACEMENTS IN ELASTIC FOUNDATIONS—By N. M. Newmark. Engineering Experiment Station Bulletin No. 367. University of Illinois, Urbana, Ill. 40c.

PREFABRICATORS AND PREFABICATING SYSTEMS—The Housing Institute, Empire State Building, New York, N. Y. $1.

STANDARD SPECIFICATIONS FOR WELDED HIGHWAY AND RAILWAY BRIDGES—4th Edition—American Welding Society, 33 West 39 St., New York 18, N. Y. $1.

PROTECTIVE ORGANIC COATINGS AS ENGINEERING MATERIALS—By J. J. Mattiello. American Society for Testing Material, 1916 Race St., Philadelphia 3, Pa. $1.50.

SUSPENDED SEDIMENT PROGRAM OF THE ROCK ISLAND OFFICE, CORPS OF ENGINEERS, U. S. ARMY—By Troy L. Péwé. U. S. Engineer Office, Rock Island, Ill.

RECENT GROUNDWATER INVESTIGATIONS IN THE NETHERLANDS—By W. F. J. M. Frul and F. A. Liefrinck. Elsevier Publishing Co., 215 Fourth Ave., New York 3, N. Y. $1.50.

CROSSINGS OF ELECTRICAL SUPPLY LINES AND FACILITIES OF STEAM AND ELECTRIFIED RAILROADS—Report of Joint Engineering Committee of Association of American Railroads (Washington, D. C.) and Edison Electric Institute (New York).

DURABILITY OF CONCRETE AS AFFECTED BY AGGREGATES—By Thomas E. Stanton. Obtainable from the National Sand and Gravel Association, Washington 4, D. C.

DEPRECIATION POLICY AND THE POSTWAR PRICE LEVEL—Machinery and Allied Products Institute, 120 S. La Salle St., Chicago 3, Illinois. Single copy 25c.

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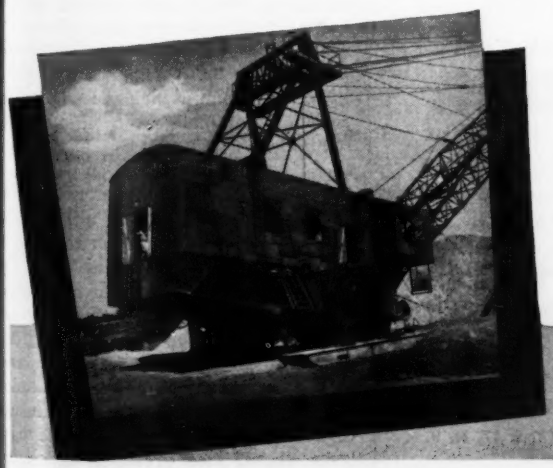

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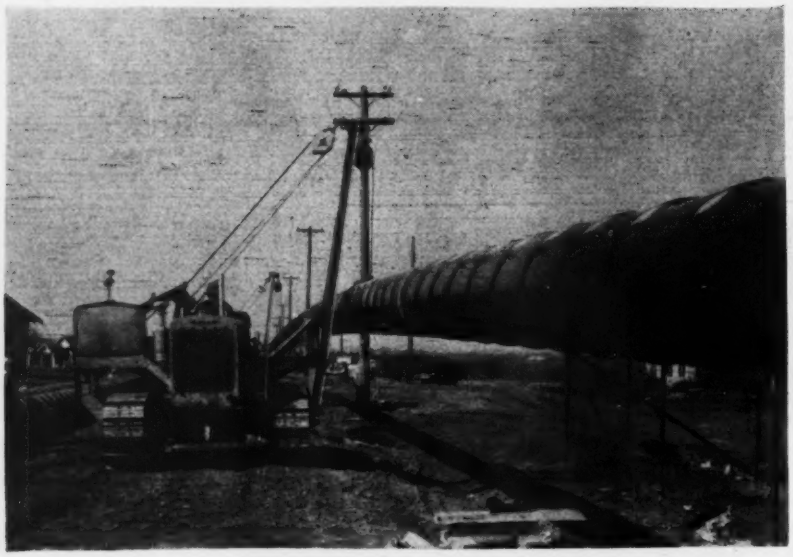

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Manufacturers' Activities

Six changes have been made in the executive functioning of the Holyoke branch of the WORTHINGTON PUMP & MACHINERY CORP. A. M. Soutter has been appointed purchasing engineer of the Holyoke works; E. E. Foote is assistant to the purchasing engineer; O. J. Schorer becomes engineering assistant to the works manager; P. H. Nast has been appointed chief engineer of the Rock Drill & Air Tool division; F. G. Riedel is chief engineer of the Freon Compressor division, retaining his title of works director of all research; Justin Neuhoff is chief engineer of the Air Conditioning and Condensing Units division.

Appointment of M. V. CORNELL of Marion as sales manager of Marion Power Shovel Co. has been announced. He has been associated with the company since 1938, in charge of sales in eastern Ohio and western New York state.

ARTHUR MCCUTCHAN, formerly with the engineering division of the Detroit Edison Co., has been appointed senior research engineer of the Product Engineering and Research Department of Tube Turns (Inc.), Louisville, Ky.

THE JOHNSTON PUMP CO., Los Angeles, Calif., recently purchased the plant and facilities of the York Universal Manufacturing Co., York, Pa., to manufacture a complete line of domestic water systems. Thomas W. Simmons, Jr., vice president and general manager of the Jet division of the Johnston Pump Co. and R. P. Porter, sales manager, Los Angeles, are moving to York to take charge of operations. The Johnson company manufacturers deep well turbines up to a capacity of 10,000 gpm., these pumps being used for irrigation, municipal water supplies and industries.

PITTSBURGH STEEL PRODUCTS CO. has been revived and will be a marketing organization responsible for the sale of the parent Pittsburgh Steel Co.'s line of construction products such as Steeltex, concrete reinforcement fabric and highway guard. Top management group of the subsidiary company is the same as for the parent organization, headed by Joseph H. Carter, president. Thomas C. Phillips and Robert L. Glose have been elected vice president in charge

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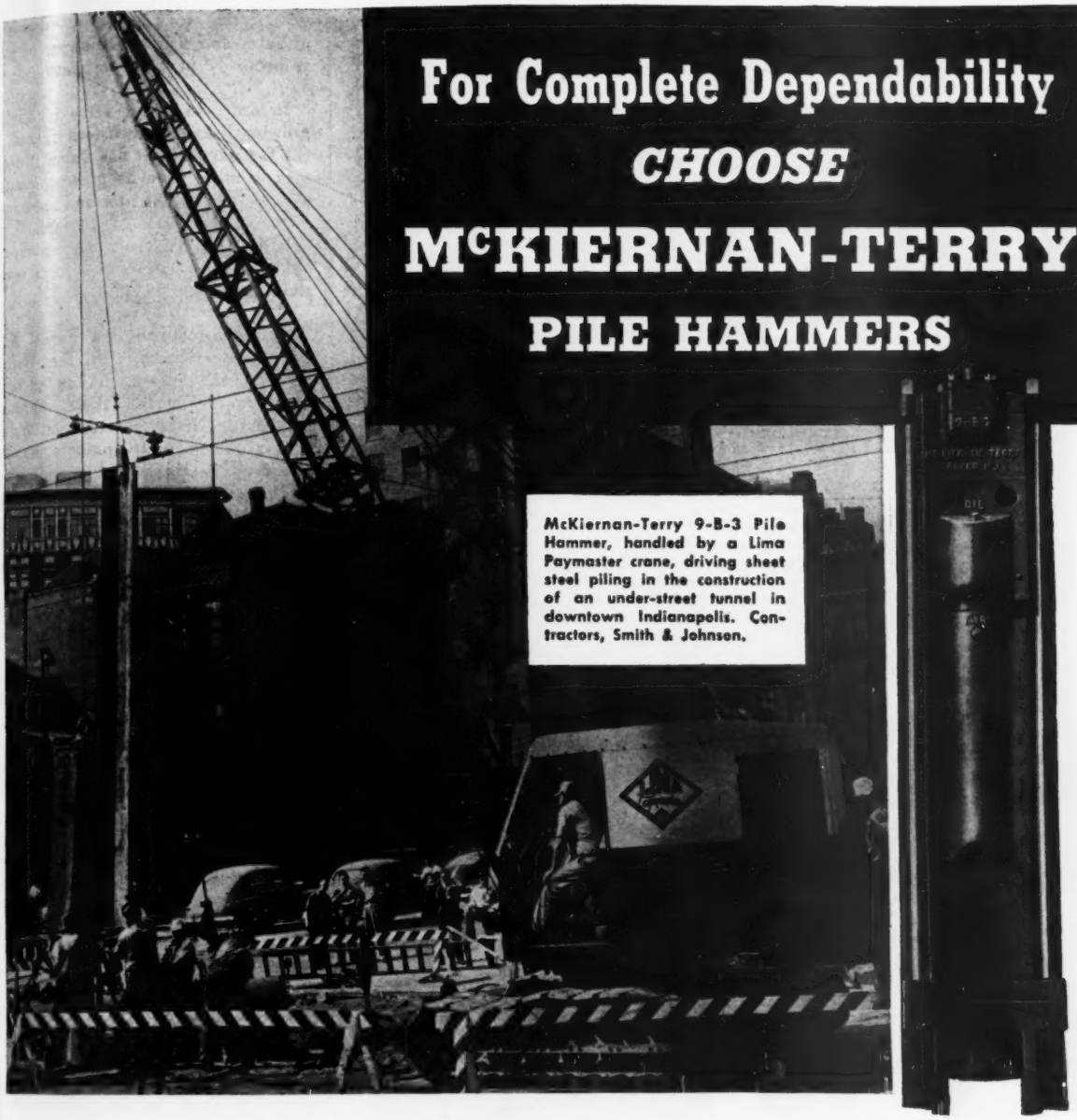

McKiernan-Terry 9-B-3 Pile Hammer, handled by a Lima Paymaster crane, driving sheet steel piling in the construction of an under-street tunnel in downtown Indianapolis. Contractors, Smith & Johnsen.

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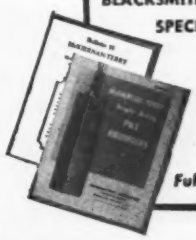

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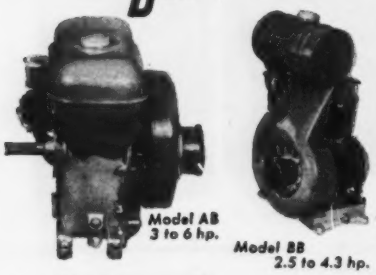

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of sales and general manager of sales respectively of the subsidiary.

In order to better serve its rapidly growing list of southeastern clients, the C.I.T. Corporation has found it necessary to move from its present quarters on Peachtree St. to new and more commodious offices at 66 Luckie St., N. W. Atlanta, Ga. The company anticipates a large volume of construction equipment financing in 1947.

Smith, Incorporated, Fargo, N.D. has been appointed by the Barber-Greene Co., Aurora, Ill. as exclusive distributor in North Dakota, representing Barber-Greene construction and industrial divisions. Products handled include bituminous mixing and paving machines, portable bulk material loaders, snow loaders, ditchers, portable and permanent belt conveyors, crushers, and coal handling equipment for retail and industrial applications.

Ralph E. Gordinier has been appointed chief research and design engineer of the Eco Engineering Co., 2 New York Ave., Newark 1, N. J., manufacturers of the Eco gearless pump for circulation of water, brine, coolants and light liquids. Mr. Gordinier will work on product development and adaptation.

Harvey C. Fruehauf, president of the Fruehauf Trailer Co., announces an agreement to acquire all of the outstanding stock of the Carter Manufacturing Co., Inc., and Carter, Inc., of Memphis, Tenn. The present management will continue to operate both companies with N. A. Carter, Sr., as president, and N. A. Carter, Jr., vice president.

Roland E. Nelson has been appointed manager of the Chicago office of the H. K. Porter Co., Inc., manufacturer of pumps and small locomotives.

The beginning of an expansion program marked by the occupation of a new plant for greater service to the building industry has been announced by Michael Flynn Manufacturing Co., manufacturer of Lupton steel windows. The new plant, at 700 East Godfrey Ave., Philadelphia, Pa., provides greatly increased production facilities.

K. A. Johnson, president of Wisconsin Culvert Co., Madison, Wis., has been elected president of the Toncan Culvert Manufacturers Association. The Association recently concluded its second national meeting since termination of the war, and is composed of representatives of fabricating companies who use Toncan iron, a product of Republic Steel Corp., in building culverts.

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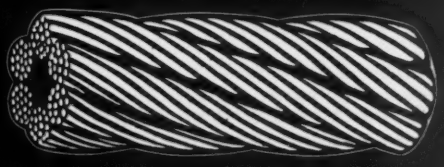

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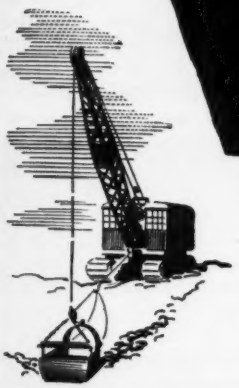

U-W Lang Lay (in which, unlike other types of wire rope, the wires and strands are twisted in the *same* direction) offers many advantages to many users.

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Lang Lay provides the greatest resistance to abrasion because the outer wires have a much greater wearing surface—*almost three times as much as regular lay!* This, in turn, provides greater metallic bearing which reduces wear on sheaves and drums as well as on the rope itself. It should, however, in almost all cases be *Preformed* to prevent untwisting and provide longer service at lower operating cost.

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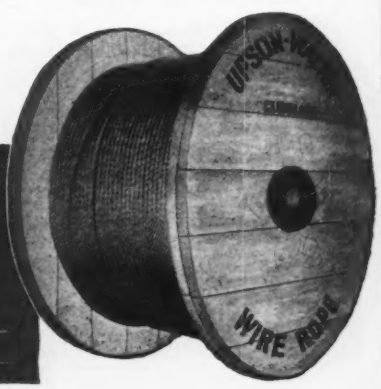

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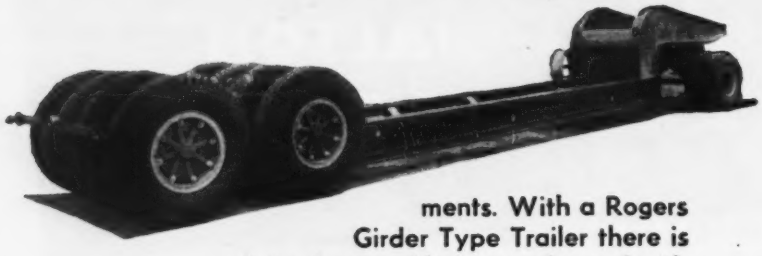

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ROGERS TRAILERS

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For ● Steel Plate Lining ● Steel encasement ● Building new walls ● Lining water reservoirs ● tunnels and sewers ● Plate lining of steel stacks, bunkers, ducts ● Repair of disintegrated concrete and masonry ● Canal, ditch and drain lining.

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BELMONT INTERLOCKING
CHANNEL FLOOR

Main Office, Philadelphia, Pa.

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and other drainage products. Headquarters are in Cleveland.

Opening of a consolidated office in Cleveland at 1071 Union Commerce Building, Zone 14 has been announced by RAYBESTOS-MANHATTAN, INC., to provide better representation and service in that territory. Other Cleveland divisional offices have also been combined in this office.

INLAND STEEL CO. has licensed Carnegie-Illinois Steel Corp. and other subsidiaries of U. S. Steel Corp. to manufacture Inland's Hi-Steel, and in return Carnegie-Illinois has licensed Inland to manufacture its Cor-Ten. Hi-Steel is a low alloy structural steel used extensively by railroads because it permits lighter weight construction without sacrifice of strength or safety, and is coming into broad use in the automobile industry.

The appointment of HENRY ROWOLD as assistant general sales manager of Mack-International Motor Truck Corp. was recently announced.

TOWNSCO EQUIP. CO., Oklahoma City, Okla., has been appointed by Barber-Greene Co., Aurora, Ill., as exclusive distributor in Oklahoma, representing the Barber-Greene construction and industrial divisions.

B. M. Kaiser has become Southwest District manager of motor trucks for INTERNATIONAL HARVESTER CO. J. T. Sullivan formerly district manager, southwest district, has been transferred to the eastern district in the same capacity.

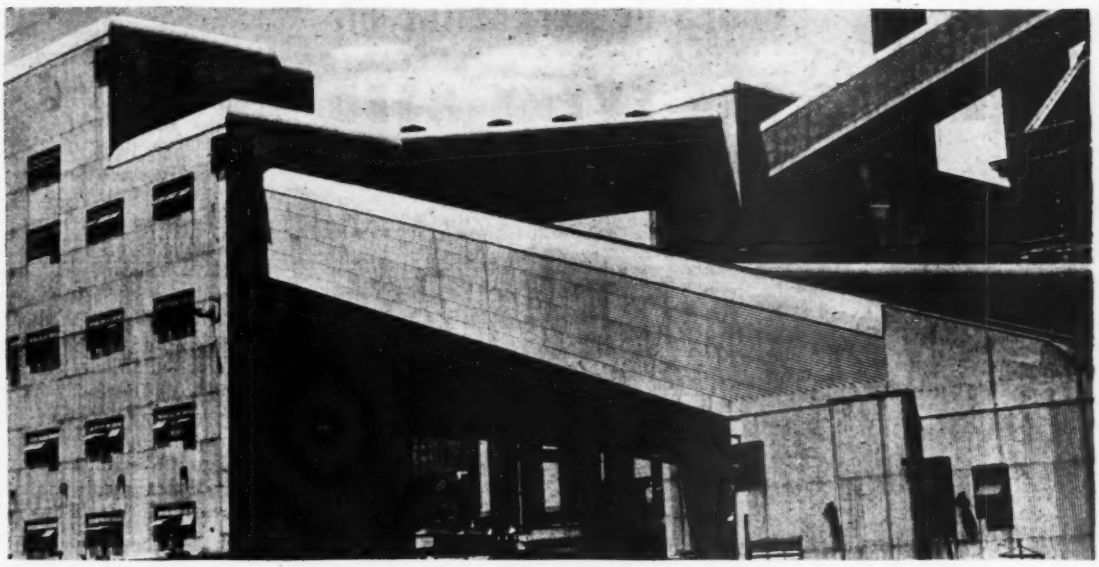
BATH IRON WORKS CORP. of Bath, Maine, has purchased all the outstanding stock of the Pennsylvania Crusher Co. of Philadelphia. The engineering personnel of the Pennsylvania Crusher Co. will remain with the company. W. S. Newell, President; J. Wm. Schulze, Vice President and Treasurer; A. H. Kretschmer, Secretary and Assistant Treasurer; and S. D. Hartshorn, Acting General Manager.

Construction involving $50,000,000 for new facilities centered on the production of new postwar products is in the engineering and planning stages and more than $22,000,000 in construction is already under way at MONSANTO CHEMICAL CO., St. Louis, Mo.

A one-story manufacturing unit and a two-story office building will be constructed at the Ypsilanti plant of the FORD MOTOR CO. Additions will be made on two sides of the present manufacturing structure.

CORRUGATED TRANSITE* . . . for utility, beauty, or both

*Transite is a registered Johns-Manville trade mark



Architects and engineers are using Johns-Manville Corrugated Transite in many ways to get that modern streamlined effect. Transite sheets can't rot, rust, or burn. And they're low in cost . . .

The smartly styled art gallery above gets some of its unusual charm from the same rugged Corrugated Transite that provides durable roofs and sidewalls for all types of industrial and commercial buildings.

Whether the project is to provide a fireproof, weatherproof exterior for a power plant or to glamorize an art gallery, Johns-Manville Corrugated Transite is *right* on the job. Use it inside, outside . . . on both new or remodeled structures.

The large rigid sheets—with their unusual strength increased by corrugations—permit a minimum of framing, thus enabling you to simplify construction and save money. They are quickly and easily applied . . . can be completely salvaged when alterations are necessary.

Made of asbestos and cement, practically indestructible materials, Corrugated Transite requires no preservatives . . . needs little or no upkeep. For further details, send for brochure. Johns-Manville, Box 290, New York 16, N. Y.

Because of unprecedented demand, there may be times when we cannot make immediate delivery. Please anticipate your needs.

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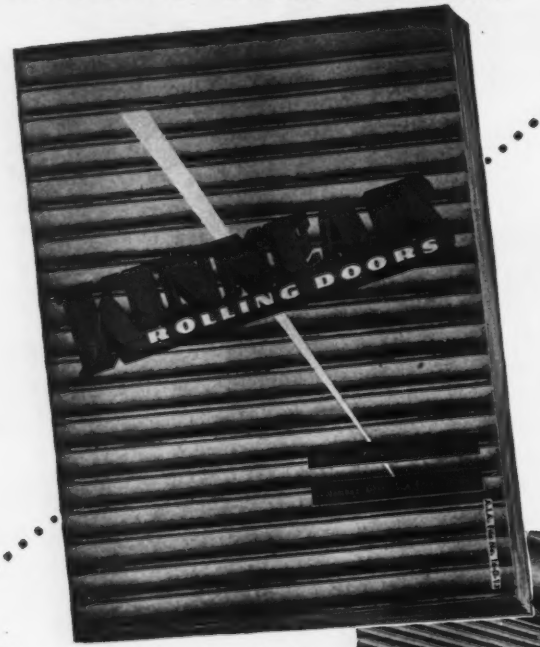

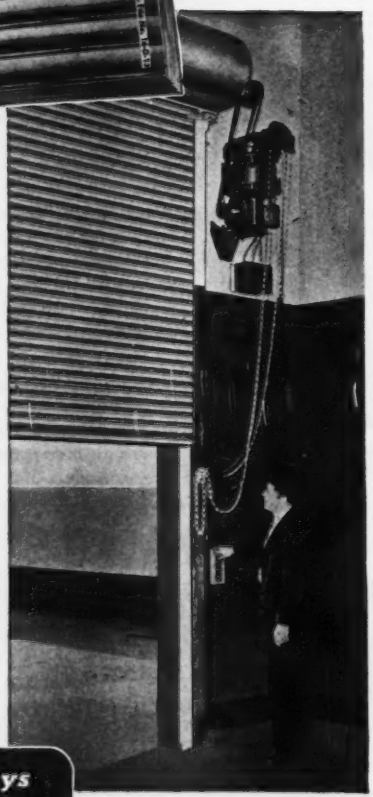

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Manufacturers' Publications

Fire Prevention—(4-p. folder) Illustrates principal steps to take in case of fire, and pictorially describes various types of fire extinguishers in plants and how they should be used.—*The B. F. Goodrich Co., Akron, Ohio.*

Resistance Welding Manual—(Revised edition, 552 pp.) Twenty new chapters have been added. Tables of recommended procedures have been revised to bring them up-to-date with respect to present-day practice. Numerous additions, based upon research and experimental work conducted during war production period, furnish operating data on materials not covered in previous editions. Price is $3.—*Resistance Welder Manufacturers' Association,* 505 *Arch St., Philadelphia,* 6, *Pa.*

Preventive Maintenance—(17x22-in. wall chart) Shows at what intervals Super C Tournapull should be serviced and lists the points to be checked or adjusted at each servicing. In addition, lubrication points are illustrated by 32 labeled photographs and chart carries recommendations as to what kind of lubricants to use and how often.—*R. G. LeTourneau, Inc., Peoria, Ill.*

Self-Supporting Cable—(52-p. manual) Contains complete engineering information on recently developed self-supporting cable construction for overhead distribution in utility systems, industrial power services and mining operations.—*Okonite Co., Passaic, N. J.*

Steel Sheets—(12-p. bulletin) Decribes use of Ferro-Therm in construction of refrigerated structures of all types. Tests by government official agencies and leading authorities are cited.—*American Flange & Manufacturing Co., Inc., 30 Rockefeller Plaza, New York, N. Y.*

Profit Insurance—(12-p. booklet) Is devoted mainly to captioned action photographs taken on typical Tournapull jobs in general construction, industrial, railroad, mining, pit and quarry, and export fields.—*R. G. LeTourneau, Inc., Peoria, Ill.*

Rubber—(28-p. booklet) Reproduces 26 case history advertisements that stress the part played by research and development in solving problems for

H-Section Welded Truss Has Wide Adaptability

By J. K. GANNETT, Vice President and Director of Engineering and Research
The Austin Company
Cleveland, Ohio

THE standard H-section welded truss designed by The Austin Company greatly simplifies the designing of one-story industrial buildings and effects many economies in their construction.

The truss, using H-Sections with all webs in a vertical plane and with all connections made by direct fillet welds without the use of gusset plates, is shop-fabricated in standard 50, 60, 70 and 80-foot lengths. It is readily adaptable to different loadings by simply changing the weights of the beams used for the various members. The depths need not be changed, thus standard jigs are used for economical fabrication. Fig. 1 shows one of the trusses being finish-welded.

The top chord is a wide flange beam that can carry purlins at a variety of spacings without regard to panel points, and is also adaptable to continuous uniform loading. The bottom chord can carry loads at any point and can be used as a monorail. See Fig. 2. Thus the truss is adaptable to a wide variety of loading demands and factory arrangements which ordinarily require specially-designed trusses.

Economical Fabrication

Fabrication is quite economical because it has been reduced to three simple operations: cutting the members to length, assembly and welding.

Since the truss members are abutting instead of lapping, it is important that they be cut to exact length and angle. A large friction saw is satisfactory for cutting the chord members, while an abrasive saw is used to cut web members to the exact angle required.

For assembly, the members are simply "laid in place" in the horizontal jig. Jigs greatly reduce production costs and insure that the webs of all members are placed in precisely the same plane. Monorail hoists are used to place the chords, but the short web members are usually so light that two men can quickly place them by hand.

After the truss is tack welded, it is removed from the jig and stood on its bottom chord, being held at the top by monorail hoists. The bottom chord joints are then finish welded as shown in Fig. 1. Then the truss is turned upside down and all top chord joints welded. This procedure permits 100% down-welding.

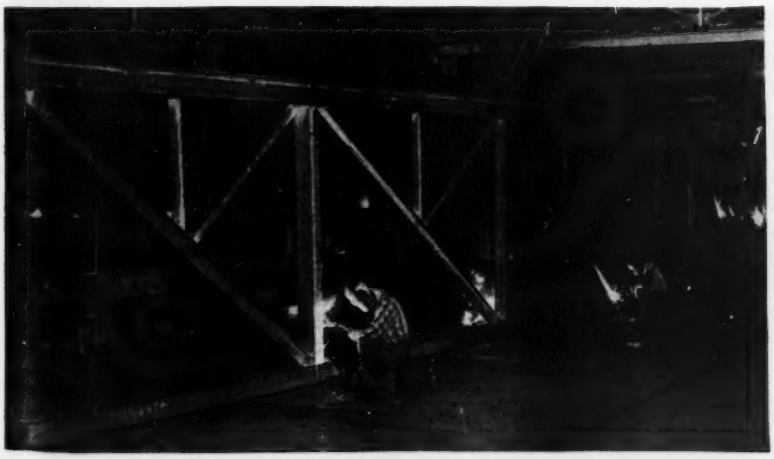


Fig. 1. Finish-welding diagonal and vertical web members to bottom chord of an H-truss.

All of the welds are fillets, ranging from ¼" to ⅜", depending on the size of the truss and the location. A 50-foot truss requires a total of 41 lineal feet of fillet welds.

No Cut Edges Exposed

The fillets are run completely around the members at their end connections. Thus all cut edges are covered and only the original rolled surfaces are exposed, which increases resistance to corrosion and simplifies painting and maintenance.

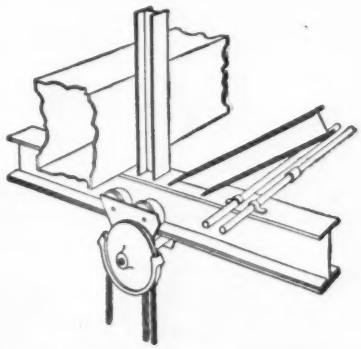


Fig. 2. How bottom chord can be used to support various loads and serve as monorail.

This fabrication procedure exemplifies the economy and simplicity obtainable in structures of good welded design. There is no punching, coping or chipping; no templates are needed; all welding is the simplest possible—horizontal fillet welding; and, except for the end connection, every pound of steel is in a truss member—there is no detail material such as gusset plates, fillers or stiffeners.

This truss has been thoroughly tested and has been—or is being—incorporated in Austin buildings, from coast-to-coast with an aggregate floor space of over three million square feet.

New developments in welded design are thoroughly described in "Studies in Structural Arc Welding," available free to engineers. Write The Lincoln Electric Company, Dept., 256 Cleveland 1, Ohio.

Advertisement

To increase the headwater at hydro plant, a Sauerman Slackline Cableway removes 80,000 cu. yd. of boulders and mud from 1,500-ft. suction of spillway, piling spoil along bank.

SLASH YOUR DIGGING COSTS with SAUERMAN CABLEWAYS

Send for booklet showing how contractors, engineers and others are using Sauerman Cableways for a variety of jobs.

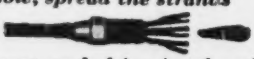
Whatever your problem of material handling, your first consideration is to keep the cost low and use as little labor as possible. When you have a contract that requires digging deep and moving material a distance of several hundred feet or more to an elevated delivery point, there is no machine as satisfactory as a Sauerman Slackline Cableway. It digs, hauls, conveys and lifts in a continuous cycle with one operator. There is a size and type of Sauerman Machine to meet your specific requirement. Low initial cost—small power consumption—inexpensive maintenance.

SAUERMAN BROS., Inc.
532 S. Clinton St. Chicago 7, Ill.

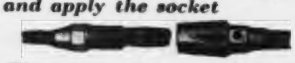
Long Range Material Handling Machines

...this Electroline FIEGE WIRE ROPE CONNECTOR

See how easily it goes on—simply slide the sleeve on the cable, spread the strands



insert and drive in the plug and apply the socket



Then see what a solid and permanent joint you have by looking at it through the inspection hole put there for the purpose.

This better connector damps vibration, prolongs wire rope life; is in fact the STRONGEST PART of a wire rope assembly.

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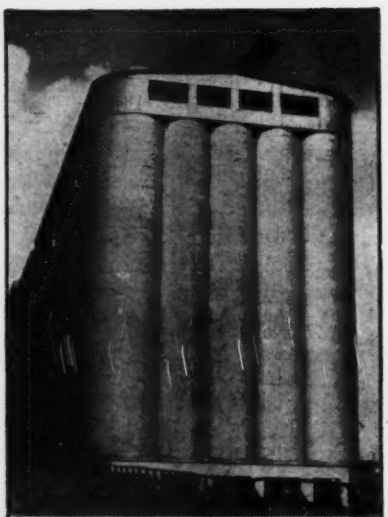

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rubber and Koroseal custom[illegible].—*B. F. Goodrich Co., Akron, Ohio.*

Trucks—(8-p. folder) Describes 10- and 12-ton trucks, built for heavy-duty service.—*Four Wheel Drive Auto Co., Clintonville, Wis.*

Magnetic Crane Controls—(20-p. booklet) Describes five types of controls for handling any type of load. Descriptive information, wiring diagrams, performance curves and application guide to aid in selecting type of a-c control best suited to any application are included. — *Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.*

Industrial Wheel Tractors—(24-p. 2-color catalog) Lists many applications for which industrial tractors are used and illustrates some of matched equipment available with them.—*International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill.*

Crushers—(Two bulletins) Describe Series SL jaw crushers and Series SGRB star gear roll crushers, giving complete specifications, capacity ratings, and dimensions together with cutaway and detail illustrations.—*Universal Engineering Corp., Cedar Rapids, Iowa.*

Equipment in Action—(16-p. color booklet) Stresses applications of company's entire line of products—diesel-powered track and wheel-type tractors, diesel motor graders, diesel industrial and marine engines and electric sets, bulldozers, scrapers, cable controls and wagons. — *Caterpillar Tractor Co., Peoria 8, Ill.*

Motor Patrol—(8-p. bulletin) Describes, illustrates and gives specifications for new, improved model Trojan utility speed patrol, which can be equipped with scarifier, bulldozer and snow plow.—*Contractors Machinery Co., Inc., Batavia, N. Y.*

Concrete Hauling—(8-p. bulletin) Describes Dumpcrete and its advantages in hauling air-entrained concrete. Specifications are given for Models 2C and 4C.—*Maxon Construction Co., Inc., Dayton 2, Ohio.*

Available Instruments—A new bulletin lists over 150 different items maintained in stock for immediate delivery. Bulletin No. W1811 lists recording thermometers, pyrometers, pressure gauges, voltmeters, ammeters, and pH recorders; also recording controllers, indicating controllers, miscellaneous instruments, and accessories.—*The Brittol Co., Waterbury 91, Conn.*